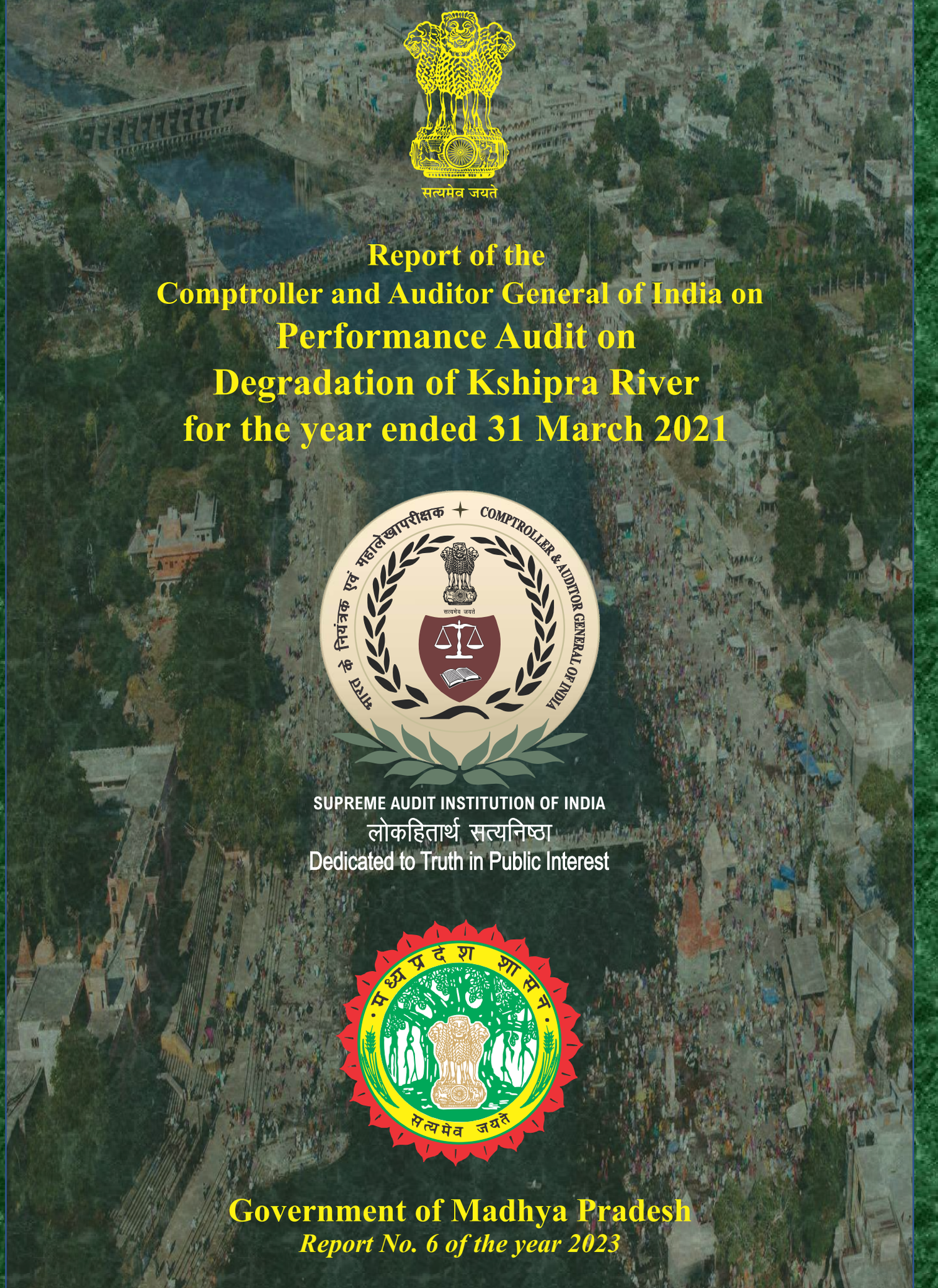

Report of the Comptroller and Auditor General of India on Performance Audit on Degradation of Kshipra River for the year ended 31 March 2021

SUPREME AUDIT INSTITUTION OF INDIA

लोकहितार्थ सत्यनिष्ठा

Dedicated to Truth in Public Interest

Government of Madhya Pradesh

Report No. 6 of the year 2023

Report of the
Comptroller and Auditor General of India

Performance Audit on
Degradation of Kshipra River
for the year ended 31 March 2021

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PREFACE

This Report of the Comptroller and Auditor General of India for the year ended 31st March 2021 has been prepared for submission to the Governor of Madhya Pradesh under Article 151 of the Constitution of India, for being laid before the Legislature of the State.

The Report contains significant results of Performance Audit on 'Degradation of Kshipra River', covering the period 2016-17 to 2020-21.

The instances mentioned in this Report are among those which came to notice in the course of test audit.

The audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

EXECUTIVE SUMMARY

Executive Summary

The Kshipra River is considered a sacred river in Madhya Pradesh. The total course of the Kshipra flows through Indore, Dewas, Ujjain, Dhar and Ratlam Districts of the State. The main tributaries of Kshipra include the Kahn River near Ujjain and the Gambhir River near Mahidpur. Over the course of time, the water quality of Kshipra River and Kahn River has degraded significantly. Kshipra River has lost its perennial flow and now runs dry for a period of five to six months per year. In fact, since 2014, water from Narmada River is being lifted and discharged into Kshipra River through Narmada-Kshipra Simhastha Link Project for the purpose of ensuring availability of water in Kshipra River especially during festivals. Audit Methodology adopted for Performance Audit on Degradation of Kshipra River is the Problem-Oriented approach of Performance Audit. The Problem-Oriented approach entails examination, verification and analyses of the causes of a particular problem. In this approach, shortcomings and problems are the starting point of an audit, not the conclusion. Accordingly, hypotheses about probable causes and consequences were formulated which have been tested during the Field Audit.

The main hypotheses developed were:

- Kshipra River has remained polluted even after multiple interventions of the State Agencies, and
- The natural flow of water in Kshipra River has reduced due to improper management and over extraction of ground water in Kshipra sub-basin.

These two hypotheses were further divided into five sub-major and 22 minor hypotheses.

The Performance Audit was conducted covering the period of 2016-17 to 2020-21, seeking to examine and bring out root causes of degradation of Kshipra River. For the Performance Audit, three Departments were audited, and information was collected from 11 Departments. Selection of the units was done based on Judgmental Sampling Method, keeping the audit units in mind that possibly have an impact on Kshipra River. The Performance Audit was also supported by Joint Physical Verification including photographical evidence of rivers, STPs, drains, plantations and other structures. Sampling and testing of water/sewage at STPs and rivers of selected locations/ sampling stations was done through Indian Institute of Technology, Indore and the reports obtained were also used for arriving at Audit Conclusion.

(Chapter I)

The five sub-major hypotheses and their test results are as follows:

(i) Untreated sewage is merging in Kshipra River.

Proper planning for the collection, treatment and disposal is necessary for the functioning of an effective sewerage system and it is most essential to collect, treat and dispose of all the waste

products of the city in such a way that it may not cause any hazardous effects on people residing in town as well as on the environment. However, the audit brought out that two ULBs (Ujjain, Alot) did not prepare City Sanitation Plans, three ULBs (Indore, Ujjain and Dewas) did not plan for sewerage network coverage of the entire geographical area and had exaggerated their SLB targets of sewerage network to show better performance. Achievements vis-à-vis the targets were actually poor. Further, the urban sewage schemes involve treating large volumes of sewage. The construction and execution of sewerage network and its functioning should be economical and efficient so that complete sewage generated from the city could be treated and the treated water can be reused suitably. However, test check of records including physical verification (substantiated by photographs) revealed that the ULBs could not treat sewage due to inappropriate sewage network despite availability of treatment capacity as sewerage connections were provided only to 46.51 *per cent* of the households. Nala Tapping work was also not executed properly. The sewerage network and STP works could not be completed as per timelines.

Areas in ULBs, where sewerage network was not available, treatment of generated faecal sludge is done through Faecal Sludge Management. The Faecal Sludge from the septic tanks can be collected in a network of drains and/or sewers and treated in a treatment plant designed appropriately. Audit observed that the five ULBs (Dewas, Ujjain, Mahidpur, Sanwer and Alot), except Indore, did not have a Faecal Sludge and Septage Management Policy, and there was no proper system of collection, transportation, disposal of faecal sludge and septage, along with proper database/records for monitoring of faecal sludge and septage management. Further, there was no mechanism for faecal sludge and septage treatment in PRIs. Effective and optimally working STPs reduce the risk of pollution in water bodies, which can be ensured through adoption of proper technology of STP and analyses of test results of various parameters of treated water. Audit observed that three STPs were working on older technologies. Moreover, prescribed tests were not being conducted and water quality parameters were not within prescribed limits. Also, alternative power sources were not available in STPs as well as in pumping stations of ULBs. In Dewas, STPs were working with only 9.89 *per cent* of total capacity. Moreover, sufficient provision for reuse of treated effluent was not made by the ULBs.

Audit recommends that the ULBs may prepare City Sanitation Plan, develop appropriate sewerage network and provide house connections to every household. They may also prepare Faecal Sludge and Septage Management Policy and develop proper system of collection, transportation, disposal of Faecal Sludge and Septage. Further, there is a need to ensure utilization of the full capacity of STPs, to make sufficient provision for reuse of treated effluent, ensure the compliance of the Action Plans and take action against erring officials for acts of omission, resulting in excess payment and non-monitoring of projects.

(Chapter II)

(ii) Treatment of industrial waste is inadequate.

For this, three Regional Offices (ROs) of MPPCB, i.e., Dewas, Indore and Ujjain, were audited for various aspects, i.e., establishment and operation of industries with active Consent to Establish (CTE) and Consent to Operate (CTO), renewal and delays related to grant of CTEs

and CTOs. The registration of Industries by MPPCB was done through XGN software. Further, as per the Water (Prevention and Control of Pollution) Act, 1974, MPPCB was authorised to issue consent to industries for establishment and operation. Audit observed that the consents were granted belatedly ranging from 46 to 615 days in all three Regional Offices of MPPCB. In addition, there were industries operational without consent as the validity of their CTO had expired and no action had been taken by the MPPCB against such industries.

In compliance with the NGT directions, CPCB instructed (December 2019) all the SPCBs to ensure that industries were inspected frequently. Audit observed that only 34 *per cent* inspections were carried out by MPPCB and 44.27 *per cent* of the selected industries were not submitting online discharge monitoring reports/monthly testing reports to MPPCB. Audit further observed that the industries were either running without ETPs or were not equipped with alternate sources of power. Further, CETPs were not available in Dewas and Ujjain and a proper mechanism for ensuring compliance with ZLD status was not available. Also, only 5.34 *per cent* of the selected industries were equipped with water meters.

Water Quality Monitoring, Guidelines, 2017 and GoMP Notification (March 1988) envisage the criteria for deciding the sampling points and the frequency and parameters to be checked for Ground Water and Surface Water and their preservation and transportation. Audit observed that the frequency and parameters tested were not as per the Water Quality Monitoring Guidelines and a smaller number of parameters were being tested. There was a shortfall in the achievement of the targets set in the monitoring package. Further, as per IIT Indore's report, numerous parameters were not in the acceptable limit.

Audit recommends that MPPCB may formulate a plan for timely issuance of the consents and develop a mechanism for ensuring that industries have an active consent, targets of inspections of industries and the targets set in the monitoring package are achieved, and ETPs and water meters are installed by industries, Further, Audit also recommends to ensure the compliance of the Water Quality Monitoring Guidelines, identify and develop a mechanism to bring the water quality parameters within the acceptable limit along with strengthening the mechanism to eliminate the elements effecting water quality of Kshipra River. Responsibility may also be fixed for allowing industries to operate without consent as well as for lack of inspections by the officers of MPPCB.

(Chapter III)

(iii) Water Quality of Kshipra and its tributaries has been adversely affected due to pollution at Riverbanks.

Various aspects viz. managing the Flood Plane Zone (FPZ), River Front Development and plantations along the FPZ of the rivers, disposal of solid waste as per the Solid Waste Management Policy of the State and efforts taken by the ULBs towards the Government of India's mission 'Waste to Wealth' were checked. Audit observed that Guidelines regarding regulations in FPZ were not issued by ULBs and encroachments were observed in the FPZ of Kahn and Kshipra Rivers. River Front Development work was not executed properly. Planning for plantations was ineffective, plantation work was doubtful, reporting of plantations and selection of sites was not correct. Further, solid waste was found to be discharged through

drains in all the selected ULBs and 'Waste to Wealth Mission' was not implemented by the ULBs (barring Indore and Dewas ULBs). Also, there were no guidelines for cleaning the Ghats of Kshipra River and for minimizing the impact of festivals on the river.

Audit recommends that the ULBs may formulate the guidelines for regulation in the FPZ and River Front Development, address the issue of removal of encroachments from the FPZ and formulate guidelines for cleaning of Ghats of Kshipra River. The ULBs may prepare Guidelines and ensure its strict implementation for minimizing the impact of festivals on the river. The ULBs and Forest Department may also develop an effective mechanism for plantation alongside Kshipra River and compliance of Solid Waste Management Policy and 'Waste to Wealth Mission' may also be ensured by the ULBs.

(Chapter IV)

(iv) Water flow in Kshipra River has reduced drastically.

Audit observed that discharge of Kshipra River at Mahidpur and Ujjain was comparatively in a better condition in 1990, which had declined sharply in 2001 and the Kshipra River turned almost dry during pre and post-monsoon seasons after 2010-11. Audit checked various aspects *viz.* provision to prevent rainwater runoff, implementation of various scientific methods to rejuvenate river water, etc. and observed that rainfall runoff was not utilised optimally for water augmentation in the area and provision for providing water in lean season into Kshipra River was made but not implemented. Thus, environmental flow in the lean season could not be achieved as enough water was not released. As per River Rejuvenation Report of Central Ground Water Board (CGWB), planting trees to increase vegetation cover along Kshipra River was a long-term but permanent solution for restoring the eco-system of the river. Audit observed that efforts for plantation were being carried out mostly at ULBs level, but Forest Department and Gram Panchayats had not shown active participation.

Audit analysed impact of Narmada Kshipra Simhastha Link Project (NKSL) and Ujjeni to Ujjain Pipeline through NVDA data with various aspects such as execution of agreement between NVDA and ULBs/ Industries for water drawl from NKSL, installation of flow meters at the intake points of NKSL, adequate release of water as per natural flow of Kshipra River and recovery of dues for proper O&M of NKSL Project. Audit observed that the GoMP had completely deviated from the earlier aim of transforming Kshipra River into a perennial river by infusing Narmada water into Kshipra through the NKSL Project. The project was executed without foresight on future O&M and recurring charges on this account and consequently there were no well-defined objectives about the future course of the project. Management of Kshipra water and water provided through NKSL was defective and the mechanism was inadequate. Audit also observed that alternative arrangements for irrigation through optimal utilisation of treated sewage water were not done.

Audit recommends that NVDA may ensure availability of sufficient water in Kshipra River in lean season, WRD/NVDA may develop a mechanism for making alternative arrangements of water for irrigation purpose. The ULBs, PRIs and Forest Department may develop an effective mechanism for plantation alongside the Kshipra River. NVDA/WRD may make efforts for the

recovery of dues of water supplied through NKSL/Kshipra River from ULBs and may make agreement for the water supplied through the Kshipra River.

(Chapter V)

(v) Flow of Kshipra River is affected due to decreasing ground water in the sub-basin.

For this, analysis of the reasons of groundwater depletion through various aspects *viz*. Ground water drawl through tube-wells by industries, existence of monitoring mechanism for ground water drawl by industries and drilling of excess tube-wells due to huge dependency of farmers on groundwater for irrigation, *etc*., was done. It was observed that NOCs had not been obtained by industries from CGWB before extracting ground water, water meters were not installed to monitor the actual ground water extraction and dependency of ground water in irrigation had increased due to lack of alternative arrangement of water for irrigation. It was also observed that identification of overexploited, semi-critical, and safe zone had been done by CGWB but only up to September 2020 and CGWB did not formulate guidelines for seven overexploited blocks of Kshipra Basin. For the remaining one block of Indore ULB, Guidelines had been formed but were not being implemented/adopted by the State agencies.

The CGWB is the nodal agency for providing guidance and technical support in the work of artificial recharging of ground water to the State Government. At State level, no single Department was responsible for execution of groundwater recharge works. Various Departments of the State Government, *viz*. PHED, Forest Department, PRIs and ULBs, according to their mandates, were engaged in the artificial recharging of ground water, however, no significant work was executed by these departments in Kshipra sub-basin. It was observed that there was a deficit between ground water extraction and artificial recharging. Artificial recharging work of aquifer mapping for long-term sustainability of local ground water resources were not done by the PHED.

Audit recommends that CGWB may encourage the industries to obtain NOC before extracting ground water and may formulate a mechanism for control of ground water extraction. CGWB/PHED/PRIs/ULBs may emphasize artificial recharging and water shed management. Forest Department may develop structures for soil water conservation.

(Chapter VI)

CHAPTER 1
INTRODUCTION

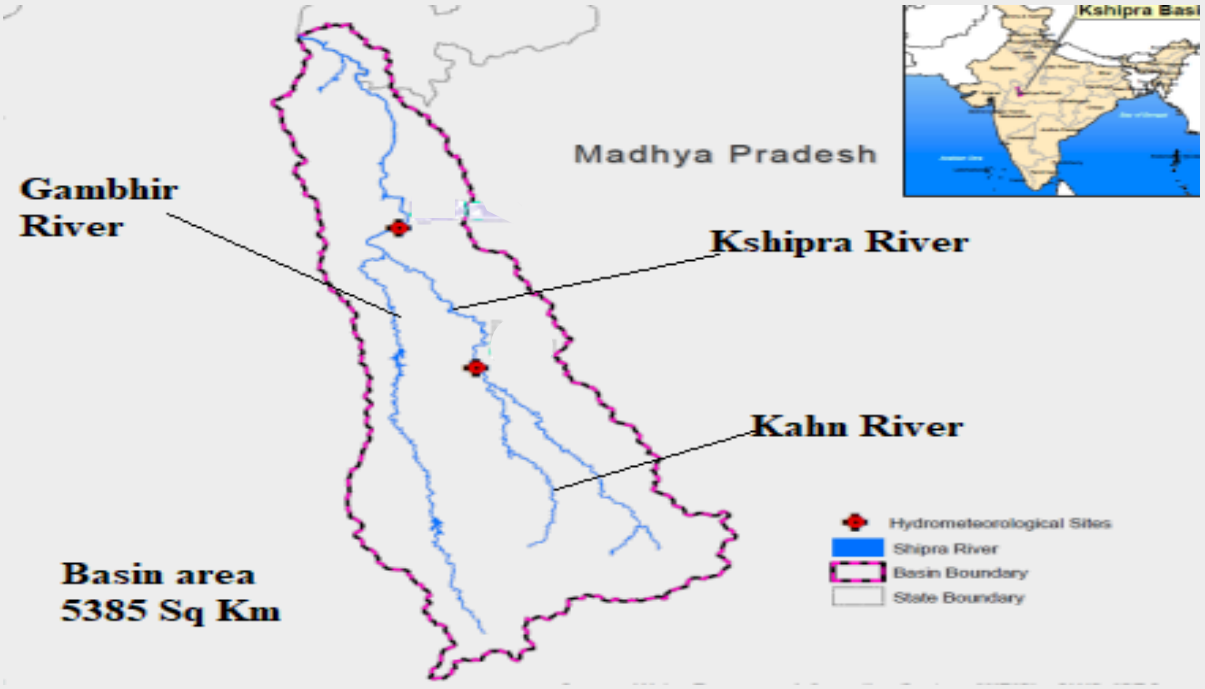
1 CHAPTER

Introduction

1.1 Introduction

Kshipra, a river in Madhya Pradesh, is also called Shipra or *Avanti Nadi*. It originates from the Vindhya Range and flows in a northerly direction across the Malwa Plateau to ultimately join the Chambal River. The river length is about 195 km having a catchment area of 5,600 sq. km. Its nominal source is on the Kokri Bardi hill, 20 km south-east of Indore, near the small village of Ujjeni (22° 31' N and 76°00' E). The watershed region of Kshipra River is given in **Image 1.1**.

Image 1.1: Water shed region of Kshipra River



(Image Source: Published by MPWRD in Kshipra River Conservation Plan)

The holy city of Ujjain is located on the right bank of the Kshipra River. The river flows in a general north-westerly direction and has a very sinuous course. The total course of the Kshipra flows through Indore, Dewas, Ujjain, Dhar and Ratlam Districts of the State. The main tributaries of Kshipra include the Kahn River near Ujjain and the Gambhir River near Mahidpur. The water of the Kshipra is used for drinking, industrial and irrigation purposes.

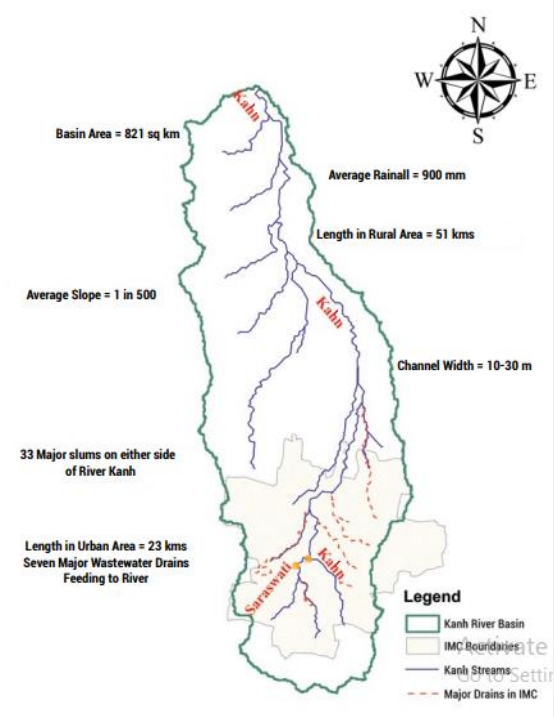
However, over the course of time, the water quality of Kshipra River and Kahn River has degraded significantly. Kshipra River has lost its perennial flow and now runs dry[1] for a period

[1] As per Central Water Commission Kshipra Sub-Basin Report (2011).

of five to six months per year. In fact, since 2014, water from Narmada River is being lifted and discharged into Kshipra River through Narmada-Kshipra Simhastha Link Project for the purpose of ensuring availability of water in Kshipra River, especially during festivals.

1.1.1 Tributaries of Kshipra River

Image 1.2 Water shed of Kahn River



(Image Source: Vision Kahn published by Indore, ULB)

Kshipra River is fed by two major tributaries namely, Kahn and Gambhir Rivers. Kahn River joins Kshipra at 70 km from origin at Triveni (Ujjain) and Gambhir River meets Kshipra River at 120 km from origin near Mahidpur. Status of Kahn and Gambhir rivers is mentioned below:

➢ *Kahn River*

Kahn River is one of the most polluted rivers of Madhya Pradesh. Kahn River carries domestic, industrial and agricultural waste from Indore Municipal Corporation, Sanwer Road Industrial Area (Indore District) and 22 villages on the banks of Kahn River between Indore and Ujjain. River Kahn runs for a length of about 72 km, of which 26 km length lies in Indore city and the balance 46 km is in rural setting as shown in **Image 1.2.**

There are 33 major slums[2] on either side of the Kahn river. Six major drains of Indore city and Saraswati River feed the Kahn River.

➢ *Gambhir River*

Gambhir is the second major tributary of Kshipra River. It originates from Janapav near Mhow (Indore) and flows from south to north until it joins the Kshipra River at downstream near Mahidpur, Ujjain. Gambhir River is also fed by water from Narmada River through Narmada-Gambhir Link Project. As per Water Quality Report, Water Quality Index of Gambhir River was satisfactory during last five years.

1.1.2 Administrative Setup and Population of Kshipra Watershed

Kshipra watershed[3] with an area of 5,777 sq. km (**Table 1.1**) is occupying central part of Malwa Plateau covering southern part of Indore, south-eastern part of Dhar, the central and northern part of Ratlam, Dewas Block and whole Ujjain District.

Districts and Blocks covering Kshipra watershed are given in **Table 1.1**. Maximum area falls in Ujjain (2,374 sq. km) and Indore districts (2,373 sq. km) and very small area falls in Dhar

[2] Data obtained from ULB, Indore (Vision Kahn).

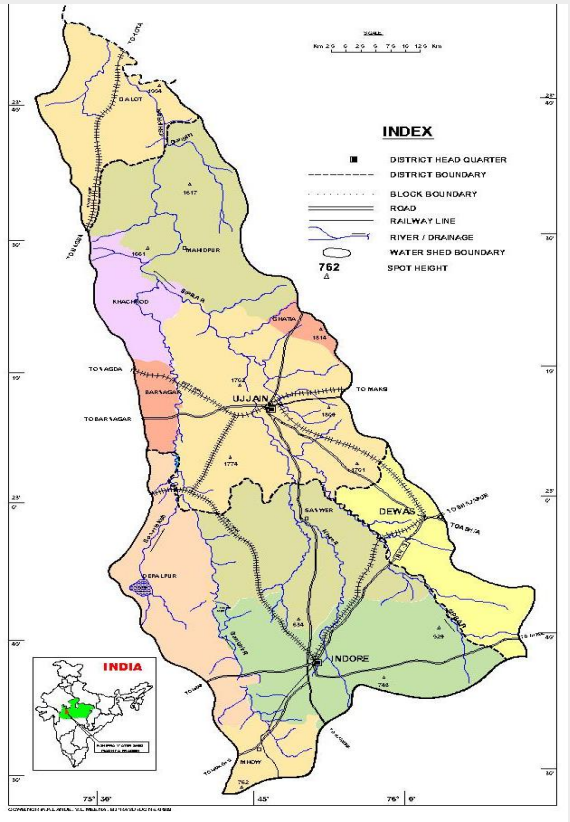
[3] Watershed is the area drained by a river and its tributaries.

district (16 sq. km).

Table 1.1: Administrative map and districts/ block wise area covered in Kshipra Watershed

(Area in sq. km)

District	Total area	Area under Kshipra Sub-basin	Block	Area
Indore	3,898	2,373	1. Mhow	**195**
			2. Indore	**881**
			3. Depalpur	**547**
			4. Sanwer	**750**
Dhar	8,153	16	1. Nalchha	**16**
Dewas	7,920	484	1. Dewas	**484**
Ujjain	6,091	2,374	1. Barnagar	**125**
			2. Ujjain	**1,152**
			3. Ghatiya	**58**
			4. Khachrod	**276**
			5. Mahidpur	**763**
Ratlam	4,861	530	1. Alot	**530**
Total	**30,923**	**5,777**		**5,777**



(Source: Report on Rejuvenation of Kshipra River by Central Ground Water Board)

1.1.3 Habitations and Population near Kshipra River

Urban Local Bodies

Six Urban Local Bodies (Three Nagar Nigams, one Nagar Palika Parishad and two Nagar Parishads) are nearby the banks of Kshipra River with population of 28.41 lakh as per 2011 Census, whereas projected population of these Urban Local Bodies as of 2021 is 42.36 lakh.

Villages

There are total 10 Tehsils on the banks of Kshipra and Kahn Rivers having a total of 212 villages with projected population of around 2.85 lakh in 2021.

1.1.4 Stop Dam/Barrage on Kshipra River

A total of 18[4] stop dams had been constructed on Kshipra River by Madhya Pradesh Water Resource Department (MPWRD) and ULBs (Dewas and Ujjain) having total storage capacity

[4] Babalia Khurd Stop Dam, Mundiwarang Stop Dam, Goga Khedi Stop Dam, Semalia Chau Stop Dam, Jalod Stop Dam, Dugariya Stop Dam, Bhudwasa Stop Dam, Kshipra Stop Dam, Kshipra Barrage, Puadra Happa Stop Dam, Simrola Barrage, Chimli Stop Dam, Alampur Udana Stop Dam, Kithoda Stop Dam, Triveni Stop Dam, Gaughat Stop Dam, Karkraj Stop Dam and Ramghat Stop Dam.

of 599.13 million cubic feet (MCFT).

1.1.5 Drains merging into Kshipra River

Kshipra River flows through or passes nearby six ULBs and 212 villages. Total 28 drains of these Six ULBs and villages merge into Kshipra River directly or indirectly. These drains carry sewage and industrial waste in to Kshipra River along with storm water.

1.1.6 Industries along Kshipra River

Kshipra River also flows through major Industrial region of Madhya Pradesh. Industrial area of Dewas, Ujjain, Mahidpur are situated along Kshipra River. Further, Kahn River, which is one of major tributary of Kshipra River, also passes through Sanwer road Industrial area and multiple industries of Indore as well. A total of 6,777 industries including 2,844 water polluting industries were being operational in Dewas, Indore and Ujjain Districts in the catchment of Kshipra River and its tributaries.

1.2 Scope of Audit

The scope of Audit includes examination of records for the period of 2016-17 to 2020-21 at three[5] Departments and collection of information from 11[6] Departments. These Departments are closely involved in the implementation of projects relating to rejuvenation of Kshipra River. Selection of the units was done based on Judgmental Sampling Method, keeping in mind the audit units that can have an impact on Kshipra River.

Causes of degradation of Kshipra River were analysed and hypotheses about possible causes and consequences were formulated and the same were tested during field audit. The Performance Audit was also supported by Joint Physical Verification including photographical evidences of Rivers, STPs and drains. Further, sampling and testing of effluents at STPs and water of selected locations at Kshipra and Kahn Rivers was done through Indian Institute of Technology (IIT), Indore and the Reports obtained were also used for arriving at audit conclusions.

The Entry Conferences with the Principal Secretaries (PS) of Urban Development and Housing Department (UDHD), the Environment Department and Public Health Engineering Department (PHED), were held on 25 October 2021, 24 November 2021 and 26 November 2021 respectively, wherein problem statement, scope and criteria were discussed. The Exit Conference with the PS, Environment Department and representatives of various[7] departments was held on 21 February 2023. Hypotheses and Audit Observations were discussed in the exit conference.

Replies of Audit Observations, wherever received, have been appropriately incorporated.

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5 Urban Local Bodies, Madhya Pradesh Pollution Control Board and Public Health Engineering Department.

6 Forest Department, Madhya Pradesh Industrial Development Corporation, Water Resources Department, Narmada Valley Development Authority, Central Ground Water Board, Central Pollution Control Board, Panchayat Raj Institutions, Farmer Welfare and Agriculture Development, Land Revenue, Energy Department and Central Water Commission.

7 Urban Development and Housing Department, Public Health Engineering Department and Water Resources Department.

1.3 Audit Criteria

Following Acts/Rules/Guidelines/Orders have been used for testing hypotheses and Audit Questions during field audit:-

1) The Water (Prevention and Control of Pollution) Act, 1974;
2) The Water (Prevention and Control of Pollution) Rules, 1974;
3) The Environment (Protection) Act, 1986;
4) Orders/guidelines issued by National Green Tribunal (NGT)/Central Pollution Control Board (CPCB) regarding rejuvenation of polluted river stretches;
5) Schedule of Rates issued by UADD, 2012 and Municipal-by-laws;
6) Central Public Health and Environmental Engineering Organisation (CPHEEO) Manual 2013 for Sewerage and Sewage Treatment Systems;
7) Madhya Pradesh Municipal Corporation Act, 1956 and Madhya Pradesh Municipalities Act, 1961;
8) Flood Plain Zones (Regulation and Development) Act, 2005;
9) Govt. of Madhya Pradesh State Level Policy (2017) for Waste Water Recycle and reuse and Faecal Sludge Management (FSM);
10) Solid Waste Management Rules (SWM), 2016;
11) Acts, Notifications, Guidelines and Manual issued by Urban Development and Housing Department, Narmada Valley Development Department, Central Pollution Control Board, Madhya Pradesh Pollution Control Board, Madhya Pradesh Water Resources Department, Madhya Pradesh Public Health Engineering Department, Central Ground Water Board, Forest Department, Farmer Welfare and Agriculture Development Department, Madhya Pradesh Land Revenue and Madhya Pradesh Energy Departments.

1.4 Audit Methodology

Audit Methodology adopted for Performance Audit on Degradation of Kshipra River is the Problem-Oriented approach. Problem-Oriented approach entails examination, verification and analyses the causes of a particular problem. In this approach, shortcomings and problems are the starting point of an audit, not the conclusion. Accordingly, hypotheses about probable causes and consequences were formulated which have been tested during the field audit. Generally, the Problem-Oriented approach to Performance Audit includes the following six steps:

Identification and Statement of Problem	•Pollution and degradation of Kshipra is a major problem.
Research and study of possible root causes for the problem (Root cause analysis)	•Possible root causes have been identified through various studies and brainstorming sessions with MPPCB/Local bodies/CGWB/CPCB and through various trainings/ discussions/ physical visits.
Formulation of hypotheses based on the root cause analysis	•Multiple Major/Sub Major/Minor hypotheses have been developed and represented on the basis of a Fishbone Diagram.
Testing of hypotheses during audit	•Audit Questions have been developed for testing these hypotheses during field audit.
Reporting whether or not the hypotheses on various causes to the problem were found true	•Hypotheses have been tested during audit of selected units of various departments.
Recommending solutions to rectify the problem after identification and testing of root cause(s)	•On the basis of result of hypotheses, recommendations have been developed to rectify the issues to control the Degradation of Kshipra River.

1.5 Identification of Problem – Degradation of Kshipra River

The Kshipra is considered a sacred river in Madhya Pradesh. In the last few decades, this perennial river has lost its glory. The sewage of Ujjain City and industrial waste from Dewas town finds its way into Kshipra. Further, sewage and industrial waste of Indore city is also merging in Kshipra through Kahn River. Flow of water in Kshipra River has diminished, especially during non-rainy seasons. The degrading condition of Kshipra River can be attributable to depleting water quality and diminishing flow in Kshipra River.

1.5.1 Depleting water quality

The problem of pollution in Kshipra River water has aggravated because of the uncontrolled flow of municipal and domestic sewages that merge directly into Kshipra River. Kshipra River is now dry in long stretches[8] and wherever one finds water, it is all mixed with solid waste, sewage and silt. The present pollution loads also contain a lot of toxic heavy metals of industrial area of Indore merged by Kahn River's water. Consequently, the river does not have a continuous water flow, due to which the Kshipra River lacks the self-purification system of Rivers and Streams.

As per the Report (September 2018) of Central Pollution Control Board (CPCB), Polluted River Stretches are those where polluted locations are in a continuous sequence. CPCB had

[8] At Mahidpur, as per Water Quality Index of March 2018, published by the MPPCB.

further categorized two stretches in Kshipra and its tributary Kahn River as Priority-1[9]. Polluted River Stretches have been detailed in **Table 1.2.**

Table 1.2: Priority I River stretches identified in Kshipra and Kahn Rivers

S.N.	Name of River	Polluted Stretch	BOD Range	Priority of stretch
1	Kshipra	Siddhawat to Triveni Sangam	4 to 38 mg/l	Priority I
2	Kahn	Kabitkhedi to Khajrana	30.8 to 80 mg/l	Priority I

According to the Action Plan for Rejuvenation of Kahn River, the Kahn River originates from Limbodi tank and meets river Kshipra at Triveni Sangam, Ujjain after travelling about 72 km distance. The whole length of the river Kahn is found to be polluted mostly due to sewage of Indore city.

A comparative analysis of water quality status at various monitoring stations in Kshipra and its tributary Kahn is detailed in **Table 1.3.**

Table 1.3: Water quality status Kshipra River and its tributaries at various monitoring Station

S.N.	River	Monitoring Station	March- 2018	March-2020	March-2021
1	Kahn River	River Kahn at Kabit Khedi	Not satisfactory	Not satisfactory	Not satisfactory
2		River Kahn at Shakkar Khedi	Not satisfactory	Not satisfactory	Not satisfactory
3		River Kahn at Sanwer	Not satisfactory	Not satisfactory	Not satisfactory
4	Kshipra River	River Kshipra at Ramghat, Ujjain	Not satisfactory	Not satisfactory	Not satisfactory
5		River Kshipra at one km downstream Triveni, Ujjain	Not satisfactory	Not satisfactory	Not satisfactory
6		River Kshipra at Siddhwat, Ujjain	Not satisfactory	Not satisfactory	Not satisfactory
7		River Kshipra at Gaughat	Not satisfactory	Not satisfactory	Not satisfactory
8		River Kshipra at Mahidpur	Dry	Not satisfactory	Satisfactory
9		River Kshipra at Kshipra-Suklya, Dewas	Satisfactory	Satisfactory	Satisfactory
10	Gambhir River	Gambhir at Ujjain	Satisfactory	Satisfactory	Satisfactory

(Source: Data from Madhya Pradesh Pollution Control Board)

From the above, it is clear that water quality status of Kshipra and its tributary, Kahn River was continuously unsatisfactory at seven out of total 10 monitoring stations. The entire river stretch of Kahn River and significant part of Kshipra River was under seriously polluted state.

1.5.2 Depleting water level

As per Aquifer Mapping Report by CGWB, "Hydrogeology in Upper catchment of Kshipra river in parts of Indore, Dewas and Ujjain", Kshipra river used to be perennial till 1996 and thereafter, the river flow reportedly reduced progressively. At present, the river remains dry in

[9] CPCB had categorized Polluted River Stretches into Priority (I to V) on the basis of Biological Oxygen Demand. Priority 1 is highest polluted river stretch having BOD 30mg/l and above, Priority 2 is having BOD between 20 and 30 mg/l, Priority 3 is having BOD between 10 and 20mg/l, Priority 4 is having BOD between 6 and 10 mg/l and Priority 5 is having BOD between 3 and 6 mg/l.

stretches for a period of six to seven months, *i.e.*, from November onwards.

The Report further states that during summer (April-May), river channel is transformed into a series of disconnected turbid ponds or pools of water and absence of any hydraulic connection between them renders them stagnant and polluted. After onset of monsoon, that is usually the month of June, these ponds are again hydraulically connected. During rainy season, the low-lying areas along the bank of Kshipra River, including Ramghat, Indore Gate, Railway Colony, Kartik Chowk, Harsiddhi areas of Ujjain, *etc*., are frequently flooded and heavily inundated. Further, analysis of hydrological data of Central Water Commission (CWC) at two observing stations (Ujjain and Mahidpur) revealed that the flow of water in Kshipra River has shown a reducing trend. (Additional details in Paragraph 5.1)

Since 2014, five Cumecs of water from Omkareshwar project is being transferred to Kshipra River under Narmada-Kshipra Simhastha Link Project through a pipeline near the village Ujjeni (*i.e.*, at the origin of Kshipra River) as and when required.

1.6 Statement of Problem /Audit Objective

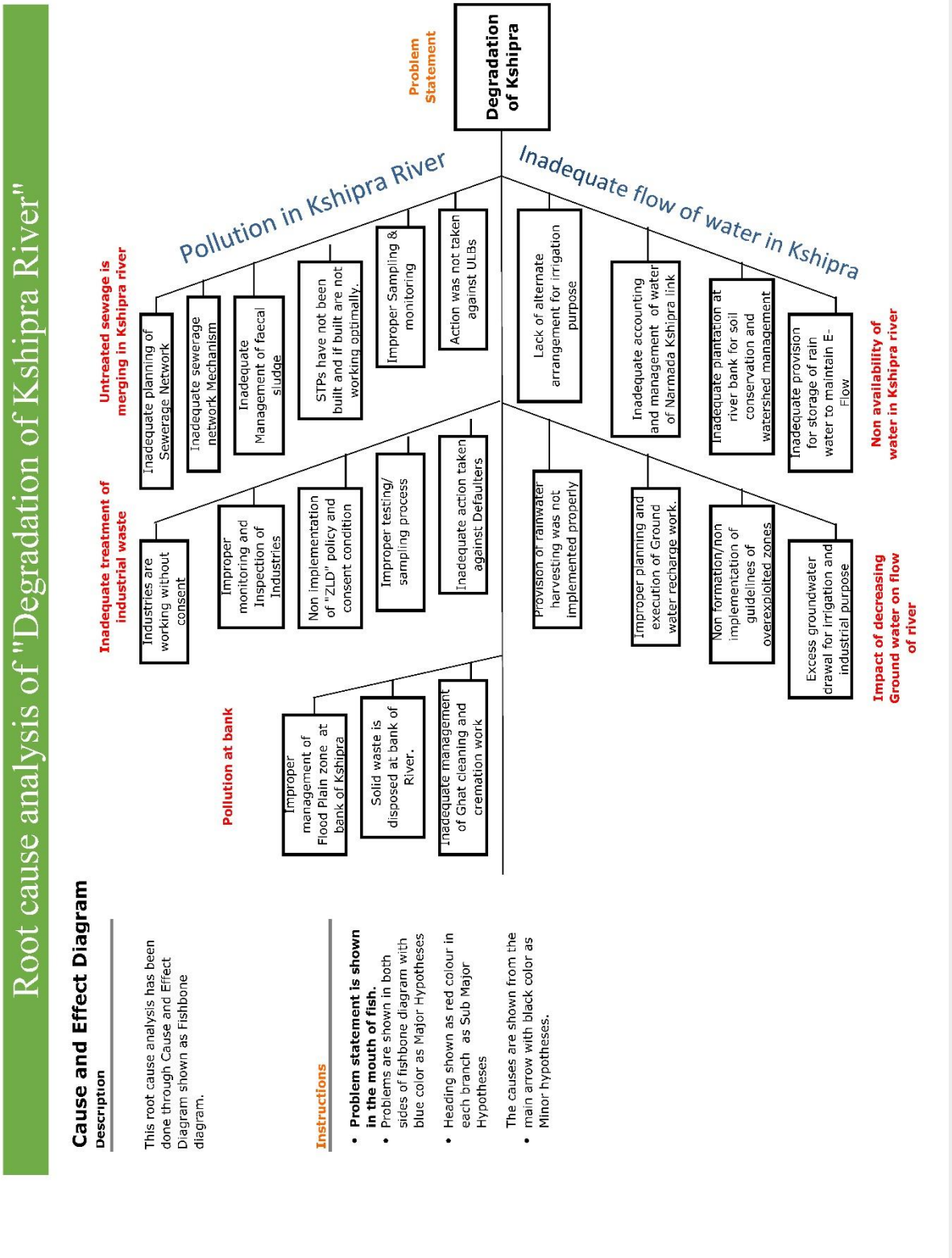
Problem-Oriented Performance Audit seeks to examine and bring out the root causes of the degradation of Kshipra River for which two hypotheses are being tested in the Audit:

1. Kshipra River has remained polluted even after multiple interventions of the State Agencies.
2. The natural flow of water in Kshipra River has reduced due to improper management and over extraction of groundwater in Kshipra sub-basin.

These two major hypotheses have been further divided into five sub-major hypotheses, *i.e.*

1. Untreated sewage of ULBs is merging into Kshipra River.
2. Treatment of Industrial waste is inadequate.
3. Water Quality of Kshipra River and its tributaries had been adversely affected due to pollution at bank.
4. Water Flow in Kshipra River has reduced drastically.
5. Due to decreasing groundwater, flow of River is getting affected.

The major and sub-major hypotheses were aimed to complete our root cause analysis, which has been shown in the fish bone diagram below:


Root cause analysis of "Degradation of Kshipra River"
Cause and Effect Diagram
Description
This root cause analysis has been done through Cause and Effect Diagram shown as Fishbone diagram.
Instructions
Problem statement is shown in the mouth of fish.
Problems are shown in both sides of fishbone diagram with blue color as Major Hypotheses
Heading shown as red colour in each branch as Sub Major Hypotheses
The causes are shown from the main arrow with black color as Minor hypotheses.
Problem Statement
Degradation of Kshipra
Pollution in Kshipra River
Inadequate flow of water in Kshipra
Untreated sewage is merging in Kshipra river
Inadequate planning of Sewerage Network
Inadequate sewerage network Mechanism
Inadequate Management of faecal sludge
STPs have not been built and if built are not working optimally.
Improper Sampling & monitoring
Action was not taken against ULBs
Inadequate treatment of industrial waste
Industries are working without consent
Improper monitoring and Inspection of Industries
Non implementation of "ZLD" policy and consent condition
Improper testing/ sampling process
Inadequate action taken against Defaulters
Pollution at bank
Improper management of Flood Plain zone at bank of Kshipra
Solid waste is disposed at bank of River.
Inadequate management of Ghat cleaning and cremation work
Non availability of water in Kshipra river
Lack of alternate arrangement for irrigation purpose
Inadequate accounting and management of water of Narmada Kshipra link
Inadequate plantation at river bank for soil conservation and watershed management
Inadequate provision for storage of rain water to maintain E-Flow
Impact of decreasing Ground water on flow of river
Provision of rainwater harvesting was not implemented properly
Improper planning and execution of Ground water recharge work.
Non formation/non implementation of guidelines of overexploited zones
Excess groundwater drawal for irrigation and industrial purpose

In all Audit tested 22 minor hypotheses to arrive at Audit conclusions as shown below:

Major Hypotheses	Sub-major hypotheses	Chapters
Kshipra River has remained polluted even after multiple interventions of the State Agencies.	1. Untreated sewage of ULBs is merging in Kshipra River. (*It includes six minor hypotheses.)*	**Audit findings are discussed in Chapter 2.**
	2. Inadequate treatment of Industrial waste. (*It includes five minor hypotheses.)*	**Audit findings are discussed in Chapter 3.**
	3. Water Quality of Kshipra River and its tributaries had been adversely affected due to pollution at bank. (*It includes three minor hypotheses.)*	**Audit findings are discussed in Chapter 4.**
The natural flow of water in Kshipra River has reduced due to improper management and over extraction of groundwater in Kshipra sub-basin.	4. Water flow in Kshipra River has reduced drastically. (*It includes four minor hypotheses.)*	**Audit findings are discussed in Chapter 5.**
	5. Due to decreasing groundwater, flow of River is getting affected. *(It includes four minor hypotheses.)*	**Audit findings are discussed in Chapter 6.**

All the 22 minor hypotheses were tested through various audit questions to arrive at a true/false conclusion.

CHAPTER 2

TREATMENT OF SEWAGE

2 CHAPTER

Treatment of Sewage

Sub-Major Hypothesis No-1: Untreated sewage is merging in Kshipra River.

2.1 Introduction

One of the main causes of water pollution is the unintended disposal of untreated, partly treated, and non-point[1] sources of sewage in the water bodies. Sewage treatment is a part of public health and sanitation and falls within the purview of the State List.

The objective of a sewage collection, treatment and disposal system is to ensure that sewage discharged from communities is properly collected, transported, treated to the required degree in short, medium, and long-term planning and disposed-off/reused without causing any health or environmental problems. Audit tested the hypothesis to evaluate various stages of sewage management like planning issues, creation of necessary infrastructure and monitoring issues. Our findings have been discussed in the following Paragraphs:

2.2 Minor Hypothesis No-1: Adequate planning of Sewage Network was not done.

Proper planning for the collection, treatment and disposal is necessary for the functioning of an effective sewerage system. It is most essential to collect, treat and dispose of all the waste products of the city in such a way that it may not cause any hazardous effects on people residing in city as well as the environment.

The hypothesis was tested in six[2], Urban Local Bodies (ULBs) in respect of related aspects such as existence of City Sanitation Plan (CSP), planning of sewerage network with respect to sewage generation.

Findings based on testing of the hypothesis are discussed in the subsequent paragraphs.

2.2.1 Non-preparation of City Sanitation Plan

City Sanitation Plan was not prepared by two out of six Urban Local Bodies.

A City Master Plan (CMP) guides development, conservation and capital improvement projects

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1 Non-Point Source (NPS) pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification and other contaminants that end up on ground.

2 ULBs Dewas, Indore, Ujjain, Alot, Mahidpur and Sanwer.

to improve the quality of life in the community. The CMP includes the City's goals and objectives, land use plan, urban design, housing, infrastructure, parks, open space, transportation, economic development and preservation of historical monuments.

The CSP shall also mandatorily form part of the CMP. As per Paragraph 2.4.10 of the CPHEEO[3] Manual on Sewerage and Sewage Treatment, all local bodies are to prepare CSP for a period of 30 years considering future development and city development in line with CMP to avoid any conflicts in developing the city in the future.

The CSP involves close collaboration with other planning agencies at local, state and national levels to ensure better coordination in allocation of priorities and resources. The collection, transportation, treatment and disposal aspects, facilities, augmentation and replacement of the equipment and sites, allocation of priorities and resources should invariably be decided keeping in view the design period of the CSP.

During course of audit, it was noticed that out of the six ULBs, four[4] ULBs, except Dewas and Indore, had not prepared CSP. In absence of such plan, overall sewage management of the cities for identification, collection, treatment and disposal in systematic manner had remained incomplete as has been discussed in the succeeding paragraphs.

The UDHD, GoMP stated (January 2023) that the CSP of ULBs, Mahidpur and Sanwer had been prepared post-audit. The reply is silent on non-preparation of CSPs by ULBs, Ujjain and Alot.

2.2.2 Untreated sewage is merging into Kshipra River

Total 11,65,994 million litre (ML) of Urban sewage and 36,496.69 ML of Rural sewage was generated in the last five years (2016-17 to 2020-21) and 3,67,451 ML of this Sewage merged in Kshipra River and its tributaries without treatment.

➢ Urban Sewage Generation and its treatment

Table 2.1 shows the estimated sewage generation and its corresponding treatment capacities in selected ULBs.

Table 2.1: Year wise details of urban sewage generation

(Quantity of Sewage in million litre)

S.N.	Particulars	Years				
		2016-17	2017-18	2018-19	2019-20	2020-21
	ULB, Dewas					
1	Projected population	3,26,000	3,33,000	3,41,000	3,48,000	3,56,000
2	Sewage generation per year[5]	13,564.86	13,856.13	14,189.01	14,480.28	14,813.16
3	Treatment of sewage through Sewerage Treatment Plants (STPs)	0	0	0	0	661.53
	ULB, Indore					

[3] Published in 2013 by the Ministry of Urban Development, Government of India.
[4] ULBs, Ujjain, Alot, Mahidpur and Sanwer.
[5] Sewage generation at the rate of 114 litres per capita per day (80% of 135 lpcd water supply + six lpcd for fire *etc*.) x 365days.

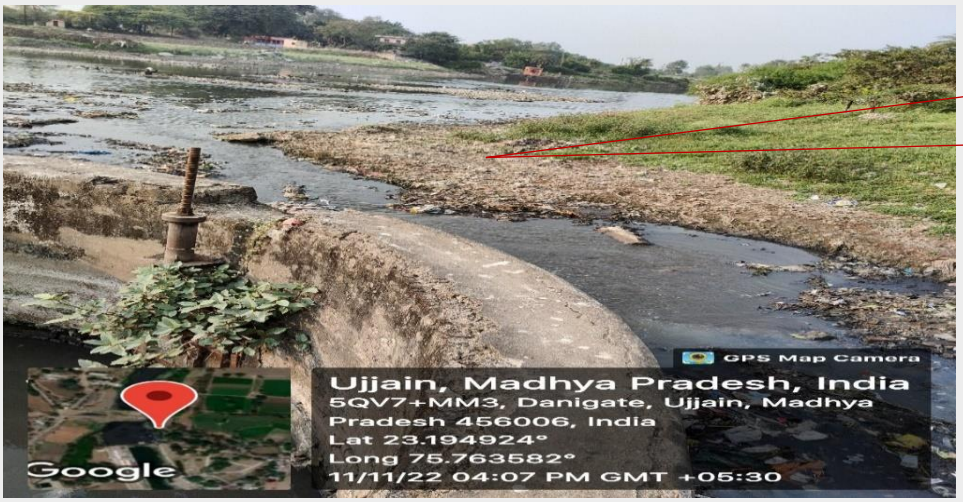
S.N.	Particulars	Years				
		2016-17	**2017-18**	**2018-19**	**2019-20**	**2020-21**
4	Projected population	26,71,699	27,69,330	28,70,017	29,68,669	30,68,338
5	Sewage generation per year	1,11,169.39	1,15,231.84	1,19,421.40	1,23,526.30	1,27,673.53
6	Treatment of sewage through STPs	1,01,311	74,231	66,499	97,709	98,572
	ULB, Ujjain					
7	Projected population	5,67,000	5,77,000	5,87,000	5,97,000	6,07,000
8	Sewage generation per year	23,592.87	24,008.97	24,425.07	24,841.17	25,257.27
9	Treatment of sewage through STPs	23,360	24,090	25,550	29,930	29,930
	ULBs, Mahidpur, Alot and Sanwer					
10	Projected population of ULBs	81,152	83,000	84,847	86,695	88,542
11	Sewage generation per year	3,376.73	3,453.63	3,530.48	3,607.38	3,684.23
12	Treatment of sewage through STPs	0	0	0	0	0
Total Sewage generation		**1,51,703.86**	**1,56,550.57**	**1,61,565.97**	**1,66,455.13**	**1,71,428.19**
Total sewage treated		**1,24,670.64**	**98,320.67**	**92,049.09**	**1,27,638.54**	**1,29,163.49**
Total of Urban sewage merged into the Kshipra River		**27,033.22**	**58,229.90**	**69,516.88**	**38,816.59**	**42,264.70**

(Source: Information provided by the ULBs, and projected population data taken from the United Nations World Population prospects)

It could be seen from the **Table 2.1** that during the period 2016-21, sewage treatment facility was partially functioning (under trial run) in the ULB, Dewas; and sewage treatment facility was not available in ULBs, Alot, Mahidpur and Sanwer (March 2022) and the generated sewage was merging eventually into the Kshipra River through different nalas. Thus, due to non-availability of sewage treatment facilities in ULBs, approximately total 2,35,861.29 ML of sewage had merged during 2016-17 to 2020-21 into Kshipra River through various nalas.

During physical verification of ULBs, Indore, Ujjain and Dewas, it was observed that multiple nalas carrying sewage waste of ULBs were merging into Kahn and Kshipra Rivers as shown in **Images 2.1-2.4.**

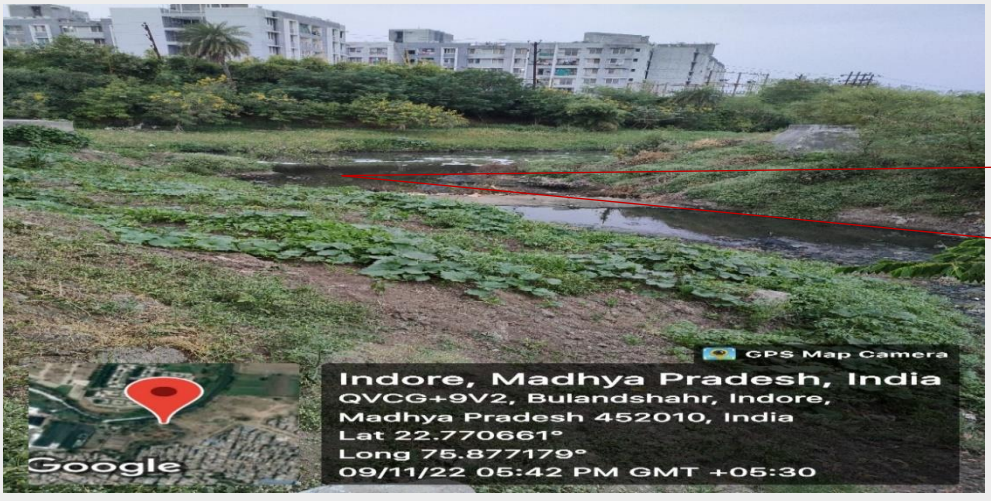
Images 2.1 to 2.4: Nala merging into Kshipra and Kahn Rivers.



Nala merging into Kshipra River at Ramghat.

Nala merging into Kshipra River at Mangalnath Ghat.

Nala merging into Kahn River at Azad Nagar before Zoo.



Nala Merging in Khan River at Kabitkhedi.

Further, water quality tests conducted by MPPCB and IIT, Indore (detailed in Chapter 3) also confirm the fact that water quality is not as per prescribed standards as sewage waste is merging into River.

The UDHD, GoMP replied (January 2023) that in ULB, Ujjain, presently 83 MLD sewage was treated at Sadawal Oxidation Pond and 92.5 MLD sewage treatment plant is under construction and will be functional by 31 March 2023.

Reply is not acceptable as 83 MLD sewage treatment at Sadawal Oxidation Pond did not provide prescribed level of treatment to sewage. Further, pump houses which were transferring sewage from different nalas to Sadawal Treatment Plant were mostly non-functional during rainy season.

GoMP had not offered any comments regarding the remaining five ULBs.

➢ Rural sewage generation and its treatment

There are 212 villages of Dewas, Indore, Ratlam and Ujjain Districts located along the Kahn and Kshipra Rivers. Year-wise details of sewage generation from these villages are given in **Table 2.2.**

Table 2.2: Year wise details of rural sewage generation

S.N.	Name of District	No. of villages	Years				
			2016-17	**2017-18**	**2018-19**	**2019-20**	**2020-21**
	Kshipra River (Total Population)						
1	Indore	32	39,150	39,810	40,470	41,131	41,791
2	Dewas	31	36,598	37,216	37,833	38,450	39,068
3	Ujjain	93	1,02,580	1,04,310	1,06,040	1,07,770	1,09,501
4	Ratlam	16	18,221	18,528	18,835	19,143	19,450
	Total	**172**	**1,96,548**	**1,99,864**	**2,03,179**	**2,06,494**	**2,09,809**
	Kahn River (Total Population)						
5	Indore	31	51,851	52,725	53,600	54,474	55,349
6	Ujjain	9	9,515	9,675	9,835	9,996	10,156
	Total	**40**	**61,366**	**62,400**	**63,435**	**64,470**	**65,505**
Grand total		**212**	**2,57,914**	**2,62,264**	**2,66,614**	**2,70,964**	**2,75,314**
Sewage generation[6] (MLD)			**15.99**	**16.26**	**16.53**	**16.80**	**17.07**
STPs available			**0**	**0**	**0**	**0**	**0**
Total Rural Sewage merging into Kshipra River (Million Litres)			**5,836.59**	**5,935.03**	**6,033.47**	**6,131.92**	**6,230.36**

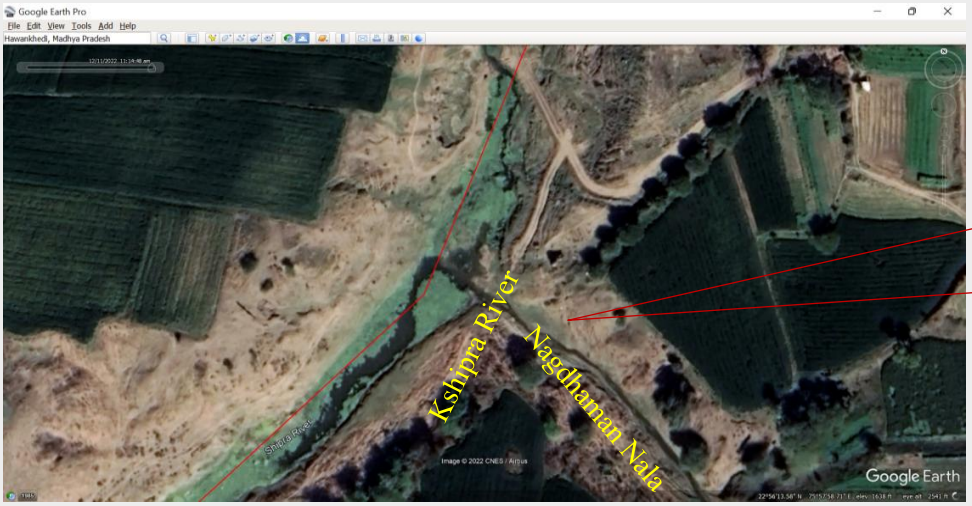
(Source: Information provided by the Panchayat Raj Institutions)

Further, as per information provided by the PRIs regarding sewage management along Kshipra River, out of 212 villages, only 55 have developed sewerage drains. The remaining 157 villages do not have sewerage drains for proper handling of generated sewage. Further, none of 212 villages has a treatment facility for generated sewage.

Hence, during the period 2016-21, no sewage treatment facility was available in the villages at the banks of the Kshipra River and its tributaries. Thus, sewage generated in these areas were merging in the Kshipra River through different nalas.

[6] At the rate of 62 lpcd (80 *per cent* of 70 lpcd water supply + six lpcd for fire, *etc*.).

Image 2.5: Nagdhaman Nala merging into Kshipra River near Village Hawankhedi (Google Earth)

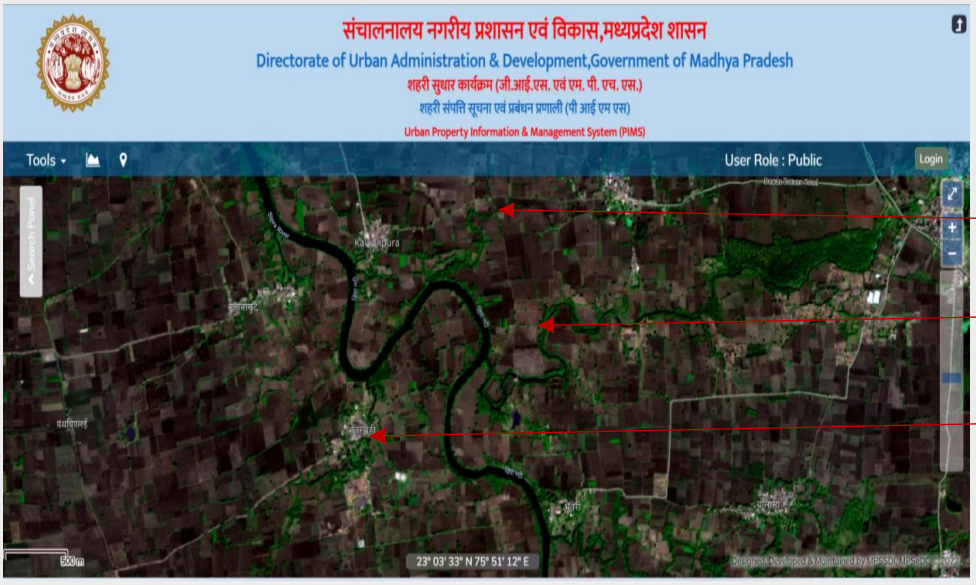


Nagdhaman Nala merging into Kshipra River near Village Hawankhedi.

Image 2.6: Medaki nala merging in Kshipra River near village Marethi (Google Earth)

Medaki nala merging in Kshipra River near village Marethi.

Image 2.7: Different Nalas merging in Kshipra River near village Kalyanpura and Sewarkhedi



Nala 1

Nala 2

Nala 3

It is clear from **images 2.5, 2.6 and 2.7** that drains from villages carrying sewage waste merge into Kshipra River, which are polluting Kshipra River.

2.2.2.1 Industrial sewage generation and its treatment

As per general conditions of the Consent to Operate (CTO) issued by the MPPCB, industries shall operate and maintain sewage treatment system to achieve prescribed standards.

There are 5,101 Industries in ULB, Indore, 778 Industries in ULB, Dewas and 898 Industries in ULB, Ujjain which employ a huge workforce, resulting in generation of sewage. Hence, these should not be treated as regular household while planning for city sewage and separate planning should be made for these entities.

Audit observed that only five industries of Dewas out of the 131[7] selected industries of Dewas, Indore and Ujjain had provision for STP to maintain above standards. However, for remaining industries, septic tanks were being used for disposal of sewage.

MPPCB replied (December 2022) that STPs are not mandatory for every industry, and they are only required in industries wherever the quantity of sewage is high. Provision of septic tanks and soak pits has been made in each industry. The reply is not acceptable as prescribed standards for sewage treatment could not be ensured, in absence of STP.

2.2.3 Improper adoption of costlier centralized system over decentralized system of STPs

ULB, Ujjain is constructing centralized system of STP, on the other hand ULBs, Dewas and Indore were working on decentralized system of STPs, Centralized system of STP is 1.7 times costlier than Decentralized system of STP.

As per Para 8.3 of the CPHEEO Manual on Sewerage and Sewage Treatment, the decentralized sewerage concept implies localised collection and localised treatment of excreta and sullage in micro zones within a major habitation, keeping it in tandem with densification and progressively duplicating it, as and when other micro zones densify. The decentralized sewage concept is advantageous due to easier prediction of sewage volumes and realistic design; smaller flows; sewer sizes are smaller and the depths of cut are also less. Thus, making it easy to construct and maintain. The STPs are smaller and it is easier to find the reuse prospects. The ecology of rivers, streams and receiving waters are better managed by smaller volumes of discharges of treated sewage at multiple locations than one massive volume in a single location because if the single available STP is out of order, the entire stretch of the water course gets polluted.

It was, however, noticed that in the ULB, Ujjain an STP of 92 million litre per day (MLD) capacity with Sequential Batch Reactor (SBR)[8] technology, along with 980 km long sewerage

[7] 31 in Dewas, 56 in Indore and 44 in Ujjain, sampled red category (including highly polluted) wastewater generating industries as detailed in paragraph 3.3.

[8] In the SBR technology, wastewater is added to a single "batch" reactor, treated to remove undesirable components and then discharged.

network has been planned and is being constructed by the M/s Tata Projects limited at village Surasa (Ujjain).

On the other hand, ULBs, Dewas and Indore had adopted a decentralised concept, which is economical and has taken less time for completion and commissioning. Sewage Treatment Plants are not available in ULBs, Alot, Mahidpur and Sanwer. A cost comparison between decentralised and centralised systems of STP is shown in **Table 2.3**.

Table 2.3: Cost comparison between decentralised and centralised systems

(₹ in crore)

S.N.	Name of ULB	System of STP	No. of STPs	Capacity of STP (MLD)	Construction Cost of STP	Cost per MLD	Status
1	Dewas	Decentralised	3	48	157.60	3.283	Operational from Jan-2021
2	Indore	Decentralised	5	67	183.60	2.740	Operational from Jan-2021
3	Ujjain	Centralised	1	92	436.58	4.750	50 *per cent* work completed

(Source: Information provided by the selected ULBs)

It could be seen from **Table 2.3** that centralised system of STP of Ujjain is 1.4 to 1.7 times costlier than decentralised system of STPs at Dewas and Indore respectively. Centralized STP is costlier due to increasing length of trunk main, pumping main and distribution/ collection network, besides costly operation and maintenance.

UDHD, GoMP accepted the fact and replied (January 2023) that at the time of preparation of the DPR in Ujjain, construction of centralized STP was proposed to prevent Kshipra River from pollution. The sewerage network of the said STP covered eight out of the total 11 nalas of Ujjain and remaining will be covered under AMRUT 2.0. However, the reply was silent about the cost impact due to centralized STP which was 1.7 times costlier than the decentralized system.

2.2.4 Inappropriate planning of STPs for future demand

STPs had not been constructed in view of future demand in ULBs, Dewas, Indore and Ujjain while in other test checked ULBs, there were no plans for STPs.

As per Para 2.13.3.4 of CPHEEO[9] Sewerage Manual, long term plan for sewage collection, treatment and disposal may be prepared for a period of 30 years from the base year[10] and alternative development sequences may be identified to provide target service coverage at affordable costs.

Audit checked the status of construction of STPs *vis-à-vis* future demand[11] in three ULBs and

[9] Involves in preparation of Technical Guidelines in the form of Manuals in the field of Public Health & Environmental Engineering which are used as basic documents by the State PHEDs / State Water Boards / UTs/ Urban Local Bodies in their functions of planning, designing, construction and O&M of water supply and sanitation schemes in the above sectors.

[10] The year of completion of STP construction is referred to as the base year. The design population and design volume of sewage shall be taken as the values in the base year.

[11] 30 years from date of completion of project.

observed that as against the planning of 1,099.26 MLD of STPs for future demand, ULBs had constructed/were constructing STPs of only 552.5 MLD. In Dewas and Ujjain, base year has been shifted by five years due to various reasons, such as delay in approval of the project, land acquisition and delayed execution. There were no STPs in ULBs, Alot, Mahidpur and Sanwer. Status of future demand of STPs and actually constructed capacity are depicted in **Table 2.4**.

Table 2.4: Requirement and availability of STPs capacity in different ULBs

S.N.	Name of ULBs	Year of completion of Sewage project	Target Year		STPs capacity for the target year	STPs actual capacity (in MLD)	Shortfall in capacity (in MLD)
			By ULBs	As per CPHEEO Manual			
1	Indore	2021	2050	2050	9,41.26	412.5	528.76
2	Ujjain	50 *per cent* work done (April 2022)	2035	2050	110	92	18
3	Dewas	2021	2040	2050	74.75	48	26.75
Total projected Sewage generation			--	0	1,126.01	552.5	573.51

(Source: Information from the selected ULBs)

From **Table 2.4**, it could be seen that there was a shortfall of capacity of 573.51 MLD STPs in ULBs, Dewas, Indore and Ujjain for the future planning of year 2050. Following shortcomings were further noticed:

- In ULB, Indore, sewage treatment facility of 335 MLD was already available (2017) in the city. ULB had further added a capacity 77.5 MLD[12] of seven STPs. Thus, as of November 2021, total sewerage treatment capacity of 412.5 MLD only is available with the ULB, Indore which is not according to the projected requirement of 941.26 MLD in 2050 indicating lack of futuristic approach in planning.
- ULB, Dewas had prepared (October 2010) a DPR for construction of Sewerage Project of 48 MLD[13] on the basis of population of 2010 (2,65,000), which was forecasted to be 4,10,000 after 30 years (2040). The project was commissioned in 2021, *i.e.*, the base year was shifted from 2010 to 2020. Therefore, by considering base year of 2020, future requirement for 2050 comes to around 74.75 MLD of sewage generation by the projected population of 6,55,690, but capacity of only 48 MLD STPs is available with Dewas. Thus, there was a shortfall of 27 MLD capacity to meet the future requirements.
- ULB, Ujjain assessed the requirement of sewerage treatment of 92 MLD for the targeted year 2035, *i.e.*, 15 years from the base year, *i.e.*, 2020, however, the target year should be 2050, *i.e.*, 30 years from the base year. Hence the required capacity should be 110 MLD. Thus, there is a shortfall of 18 MLD capacity to meet the future requirements in 2050.

UDHD, GoMP replied (January 2023) that in case of ULB, Indore, 786.50 MLD STPs were planned and a total of 416.5 MLD capacity STP had been constructed and another 55 MLD is under construction, remaining 315 MLD STP is in DPR stage. Reply does not account for 154.76 MLD STP out of total required 941.26 MLD in 2050. It was further stated that in the

[12] At Pratik Setu (eight MLD), Radhashwami Ground (six MLD), Zoo (35 MLD), Bijalpur Tank (seven MLD), Pipliyahana (0.5 MLD), ABD area Smart City (10 MLD) and Nahar Bhandara (11 MLD).

[13] 12 MLD at Shajapur Road, 14 MLD at Mendki Road and 22 MLD at Indore Road.

case of ULB, Dewas STP had been constructed as per planning by GoMP and in case of ULB, Ujjain proposal for future requirement of 110 MLD STP had been incorporated in the design of STP.

However, the fact remains that project planning and implementations was not as per future requirement as even after considering the STPs in pipeline there were massive shortfall.

2.2.5 Deficient planning of Sewerage Network

ULBs, Dewas, Indore and Ujjain failed to develop Sewerage Network that could cover complete geographical area under respective ULBs. In other three ULBs, there were no Sewerage Networks.

Sewerage Network was constructed in three out of six ULBs. Area wise coverage planning of sewerage network in ULBs are detailed in **Table 2.5.**

Table 2.5 Details of Area wise coverage of sewerage network in ULBs

S.N.	Name of ULBs	Total Area (sq km)	Area with Sewerage Network (sq km)	Area without sewerage (sq km)
1	Indore	280	134	146
2	Dewas	35	28.36	6.64
3	Ujjain	100	34.50	65.50
	Total	**415**	**196.86**	**218.14**

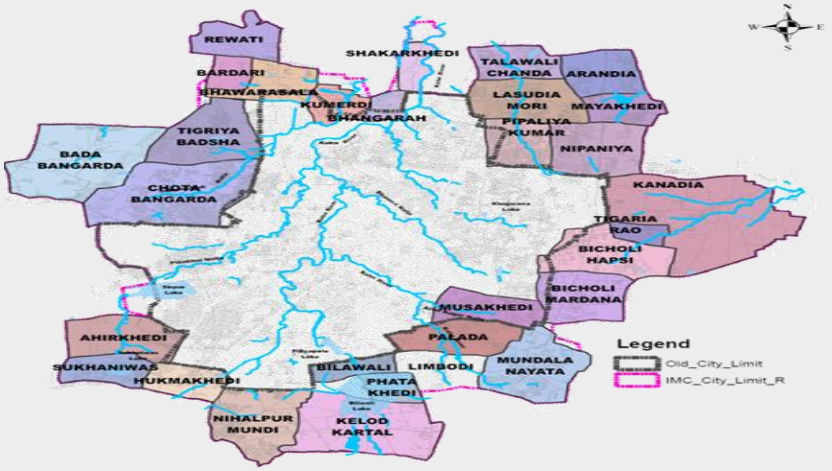
(Source: Information from the selected ULBs)

From **Table 2.5**, it can be seen that out of total area of 415 sq km, sewerage network was provided only in 196.86 sq km, which was 47.32 *per cent* of total area.

2.2.5.1 Planning for sewerage network in ULB, Indore

The total area of ULB, Indore is 280 sq km. DPR of sewerage network of Indore City was prepared (2017) without provisioning for the 29 newly added (2014) villages in the city limit. This indicated that the planning process was inadequate. Thus, the total population of 3,17,153 residing in newly added area of 29 villages had been skipped from this sewerage network. The villages that were not covered in the sewerage network have been shown in coloured shade in **Map 2.1** below**.**

Map 2.1: Villages around ULB, Indore not covered under sewerage network



(Image Source: ULB, Indore)

Aforesaid excluded population is presently generating 18 MLD[14] sewage. This sewage is merging into Kahn River through various channels.

The UDHD, GoMP stated (January 2023) that the areas of east, west and north part of ULB, Indore boundary will be covered under sewer network in the AMRUT 2.0.

The reply is not acceptable as lack of foresight while preparing the DPR in 2017 led to exclusion of these villages which had resulted in flowing of the sewage in nearby water bodies and injecting in the groundwater as well. People of these villages were also deprived of hygienic services due to this.

2.2.5.2 Planning for sewerage network in ULB, Dewas

In the ULB, Dewas, as per DPR of sewerage project, work was to be executed by the agency (October 2015) covering all 45 wards of three zones. However, the contractor laid sewerage line in 36 wards only and excluded nine[15] wards from the sewerage network without recording any reasons. Further, a separate DPR was prepared covering these nine wards with the amount of ₹ 61 crore.

The UDHD, GoMP accepted the fact and stated (January 2023) that the remaining work would be undertaken in AMRUT 2.0.

However, the original DPR had provisioned for sewerage network in these nine wards as well. Thus, the planning and preparation of DPR was deficient to that extent. Failure of the Department to assess the situation while awarding the work and subsequent modifications to the DPR thereby, resulted in additional burden of ₹ 61 crore to the exchequer.

2.2.5.3 Planning for sewerage network in ULB, Ujjain

As per the DPR, the area of Ujjain Municipal Corporation is about 100 sq km. There was no sewerage network in the Ujjain Municipal Corporation area. However, the under-construction sewerage network will be able to fulfil the requirement of about only 34.50 *per cent* area of the city.

The UDHD, GoMP stated (January 2023) that Phase 2 of AMRUT Project will cover the remaining sewerage work.

The replies of these three ULBs as regards to planning for sewerage network are not in consonance with the provisions of CPHEEO manual and NGT directives. However, delays in providing sewerage network in the entire municipal areas are contributing to the pollution in the Kshipra River apart from making population of these areas devoid of the facilities.

[14] 317153 x 70 LPCD x 80 *per cent*/10,00,000.

[15] Ward No. 5, 14, 15, 16, 29, 40, 43, 44 and 45.

2.2.6 Non-inclusion of Institutes/ Public Toilets in the sewerage system

ULBs, Dewas, Ujjain and Indore had not considered sewage waste generated from different entities such as Public Toilets, Hotels, and Hospitals, *etc*., while planning for the sewerage system.

According to Para 3.7 of the CPHEEO Manual, sewage from commercial public institutions, industries and commercial buildings often use water other than the municipal supply and may discharge their liquid waste into the sewers. Estimation of such flows should be done separately for their potable water supply.

➢ Non-inclusion of institutional sewage in sewerage network

Huge sewage generating entities include hospitals, hotels, schools/colleges, hostels, restaurants, railway stations, bus stands and plants/factories, *etc*., which use water in large quantities. These entities also discharge sewage in line with the quantity of water used. For the treatment of sewage discharged through these entities, no separate provisions/ arrangements had been made while planning the sewerage network in Dewas, Indore and Ujjain cities. Details of number of hospitals/dispensaries and hotels for which no specific provisions were made in DPRs of sewerage projects, are mentioned in **Table 2.6**.

Table 2.6: Details of number of Hospital/Dispensaries and Hotels in ULBs

S.N.	Name of ULBs	No. of Hospitals/ Dispensaries	No. of Pathologies	No. of Hotels
1	Indore	146	61	410
2	Ujjain	49	17	334
3	Dewas	77[16]		28
Total		272	78	772

(Source: ULBs, Dewas, Indore and Ujjain)

➢ Non-inclusion of Public/Community Toilets in sewerage network

There were 301 Public /Community toilets situated in various wards of Indore city and 27 Public/ Community Toilets situated in Dewas city and 90 Public/ Community Toilets situated in Ujjain city through which substantial quantity of sewage is getting discharged, however, there was no provision in the DPRs for connecting these toilets to the sewerage network.

The UDHD, GoMP accepted the facts and stated (January 2023) that in ULBs, Dewas, Indore and Ujjain, Public/ Community toilets and institutional discharge would be connected to sewerage network in future. However, the UDHD, GoMP reply did not account for the deficient planning process for Institutional sewage discharge.

2.2.7 Exaggeration of SLB targets to show better performance

ULBs had exaggerated their Service Level Benchmark achievement to show better performance.

The 13th Finance Commission had recommended sanction of Performance Grant to the ULBs

[16] In case of ULB, Dewas, information was combined for both hospitals/ dispensaries and pathologies.

with nine conditions[17]. For this purpose, baseline data was to be gathered by ULBs and after validation of data, SLB targets for succeeding fiscal years and SLB achievement of the previous year were to be published in the Gazette. Periodical review for the achievement of the targets was also to be carried out by SLB Cell of the ULBs as well as the State. As per MoUD order (April 2017), better performing ULBs will only be eligible for receiving the Performance Grant. Audit observed the following discrepancies about five notified SLB indicators which relates to sewerage network:

➢ Coverage of sewage network

As per Para 2.2.2 of SLB Handbook, this indicator denotes the extent to which the underground sewage network has reached out to individual properties across the service area. Targets notified by UADD and achievement thereof for the year 2020-21 are shown in **Table 2.7**.

Table 2.7: Notified targets and actual achievement for 2020-21 in ULBs.

S.N.	Name of ULBs	Notified target by UADD	Achievement as per ULBs	Actual achieved		
				Total Number of Households	Connected Number of House holds	Percentage of Achievement
1	Indore	95	100	4,26,903	2,63,812	61.80
2	Dewas	75	80	52,000	16,000	30.77
3	Ujjain	25	15	sewerage network is under construction		
4	Mahidpur	No targets were fixed		No achievement as sewerage network is not available.		
5	Sanwer					
6	Alot					

(Source: ULBs)

Audit noticed that UADD notified target of 95, 75 and 25 *per cent* coverage of households in Indore, Dewas and Ujjain cities respectively. The achievements shown by the ULBs were 100, 80 and 15 *per cent* respectively, but actual achievements were 62 and 31 *per cent* in Indore and Dewas respectively. Thus, the achievement was lower than the benchmark value fixed by UADD in both the ULBs. However, the ULBs exaggerated their performance in all the cases to show achievements higher by 38 to 49 *per cent*. Further, in ULB, Ujjain, no household was connected with sewerage network as the work was ongoing and in ULBs, Alot, Mahidpur and Sanwer, no targets were fixed for coverage of sewage networks.

The UDHD, GoMP did not offer any comment in this regard.

➢ Collection efficiency of Sewerage Network

As per Para 2.2.2 of SLB handbook, collection efficiency indicator is measured as the quantum of wastewater collected as a percentage of sewage generation in the ULB. Targets notified by UADD and achievement against this benchmark for the year 2020-21 are shown in **Table 2.8**.

[17] Coverage of toilets, coverage of sewage network service, collection efficiency of sewage network, adequacy of sewage capacity, quality of sewage treatment, extent of reuse and recycling of sewage, efficiency in redressal of consumer complaints, extent of cost recovery in sewage management and efficiency in collection of sewerage charges.

Table 2.8: Notified targets and actual achievement for 2020-21 in ULBs.

S.N.	Name of ULBs	SLB notified by UADD for 2020-21		Actual achievement			Exaggeration
		Target	Achievement	Sewage waste generated (MLD)	Treatment of Sewage (MLD)	Percentage of Achievement	
1	Indore	95	95	361	337.45	93.47	1.53
2	Dewas	100	100	41.38	8.25	19.94	80.06
3	Ujjain	100	100	116	83	71.55	28.45
4	Mahidpur	No Targets were fixed.		No achievement as treatment facility (STPs) not available.			
5	Sanwer						
6	Alot						

(Source: ULBs)

The notified target in respect of this indicator was 95 *per cent* for Indore and 100 *per cent* for Ujjain and Dewas cities during the year 2020-21. However, the actual achievement was 93.47 *per cent* in Indore, 19.94 *per cent* in Dewas and 71.55 *per cent* in Ujjain against notified targeted of 100 *per cent*. Further, in ULBs, Alot, Mahidpur and Sanwer targets were not even fixed for collection efficiency of sewerage networks.

The UDHD, GoMP did not offer any comments in this regard.

➢ Extent of cost recovery

Para 2.2.8 of SLB handbook envisages that all operating costs should be recovered through a combination of user charges, fees and taxes, *etc*. UDHD has also amended (September 2020) the Madhya Pradesh Municipality (User charges for Water supply, Sewerage and Solid Waste Management Services) Rules 2020. Accordingly, fixation of user charges for Water Supply, Sewage and Solid Waste management services shall be done in such manner so that annual expenditure incurred on the services can be recovered fully.

It was, however, observed that ULBs, Indore, Dewas and Ujjain had not implemented these orders as user charges were not being levied by these ULBs. Due to non-realisation of user charges, fund requirement for maintaining existing sewage system can be a huge challenge for ULBs.

The UDHD, GoMP stated (January 2023) that in the case of ULB, Dewas, only registration money is being collected from the beneficiaries at present. In the case of ULB, Indore, the rates were not approved by the competent authority at Government level. However, Government had already instructed (September 2020) the ULBs to recover the user charges which was not followed by these ULBs.

The ULBs are working with scare resources, hence, non-levy of user charges will further impact development and maintenance of various schemes.

➢ Coverage of storm water drainage network

This indicator is defined in terms of the percentage of road length covered by the storm water drainage network. As per SLB Handbook, coverage of storm water drainage network was to be computed on the basis of total length of road having more than 3.5-metre-wide carriageway in service area and total length of drains that are made of *pucca* construction are covered. The benchmark value fixed by GoI was 100 *per cent*.

Table 2.9: Notified targets and actual achievement for 2020-21 in ULBs

S.N.	Name of ULBs	SLB notified by UADD for 2020-21		Actual achievement			Exaggeration
		Target	Achieve-ment	Length of roads (km)	Coverage of road with storm water drainage (km)	Actual Percentage of Achievement	
1	Indore	95	95	1,730.24	196.29	11.00	84.00
2	Dewas	100	100	430.33	258.19	60.00	40.00
3	Ujjain	100	100	1,036.85	Not provided	-	-
4	Mahidpur	100	92	14.00	00	00	92.00
5	Sanwer	100	85	9.28	00	00	85.00
6	Alot	100	85	15.0	5.0	33.0	52.00

(Source: Selected ULBs)

It can be seen from **Table 2.9** that against the notified targets of storm water coverage of 95-100 *per cent*, the selected ULBs have shown that their achievement range from 85 - 100 *per cent*. However, as per Audit, actual achievement ranged between zero and 60 *per cent*, but the ULBs had exaggerated their achievement.

Thus, the coverage as well as the notified target was lower than the benchmark value (100 *per cent*) fixed by GoI.

The UDHD, GoMP stated (January 2023) that ULBs, Alot, Mahidpur and Sanwer had achieved 80 *per cent* of storm water coverage, in case of ULB, Dewas, DPR had been sent to GoMP under SDRF (State Disaster Response Fund) and SDMF (State Disaster Mitigation Fund) for storm water drains. The Reply was silent about ULBs, Indore and Ujjain. Further, no documentary evidence was provided in support of replies regarding the claim about present status of storm water coverage.

Conclusion: *The Minor Hypothesis was mostly true. It was observed that two ULBs did not prepare City Sanitation Plans. Three ULBs did not plan for sewerage network coverage of the entire geographical area.*

Further, three ULBs had exaggerated their SLB targets to show better performance. Achievement vis-à-vis the targets was poor.

2.3 Minor Hypothesis No-2: Adequate Sewerage Network mechanism is not available to cater the built-up STPs, and therefore, untreated sewage waste is directly merging in the Kshipra River.

Urban sewage schemes involve treating large volumes of sewage. The sewers conveying sewage to the STPs can be pipes or in-situ constructed conduits passing through dense areas. Construction and execution of sewerage network and STPs should be economical, and its functioning should be efficient so that complete sewage generated from the city could be treated and the water output can be reused suitably.

The hypothesis was checked at ULB level through various aspects, *i.e.*, availability of sewerage

network and its execution including provision for Nala Tapping[18] ***(Image 2.8),*** connecting houses/residences to the sewerage networks, utilisation of funds, *etc*.

Findings on testing of the hypothesis are discussed in detail in following paragraphs:

2.3.1 Inappropriate sewerage network created in proportion to STPs built

In ULBs, Indore, Ujjain and Dewas, despite availability of treatment capacity, waste generated could not be treated due to inadequate sewerage network.

Sewage generation from the cities is estimated on the basis of population, but due to lack of judicious uses of water, sewage generation is much higher than estimation.

Actual sewage generation depends upon the water utilized by population. Actual water utilisation includes quantity of water supplied by ULBs to the population through connected pipelines and utilisation of groundwater by unconnected population.

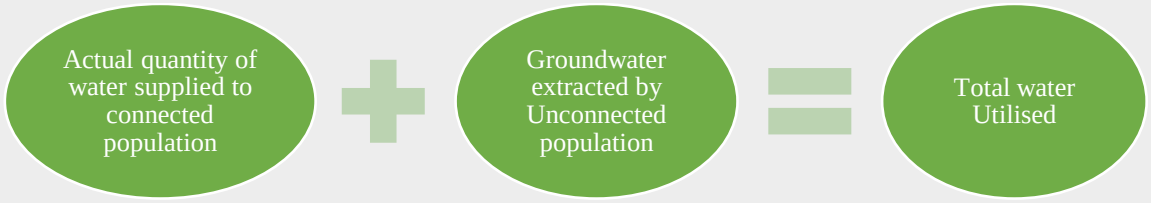


Table 2.10: Water supplied and treatment provided in ULBs, Indore, Ujjain and Dewas

(Water supply and sewage generation in Million Litres)

Particulars	Sewage generation due to water consumption by the citizens of ULBs				
	2016-17	2017-18	2018-19	2019-20	2020-21
Net Water supplied to the households of ULB Indore	1,26,892.25	1,38,371.50	1,38,681.75	1,62,881.25	1,65,828.63
Sewage generated during a year at 80 *per cent* of supplied water	1,01,513.8	1,10,697.2	1,10,945.4	1,30,305	1,32,662.9
No. of remaining households that have their own sources	1,85,973	1,85,973	1,71,973	1,68,902	1,64,334
Water consumption by the remaining houses from own sources (@ 135lpcd*5 members)	45,819	45,819	42,370	41,613	40,488
Sewage generation by households where water is not supplied by the ULB	36,655.28	36,655.28	33,895.88	33,290.58	32,390.23
Total sewage generated in ULB Indore	1,38,169.08	1,47,352.48	1,44,841.28	1,63,595.58	1,65,053.13
Treatment done through STPs of Indore	1,01,310.64	74,230.67	66,499.09	97,708.54	98,571.96
Untreated wastewater which could not reach up to STPs for treatment	36,858.44	73,121.81	78,342.19	65,887.04	66,481.17
Total wastewater which could not reach up to STPs of Indore for treatment-1					**3,20,690.65**
Net water supplied to 31,750 out of 52,000 household in Dewas	5,145.24	5,822.76	8,937.00	10,859.00	12,045.00
Sewage generated during a year at 80% of supplied water	4,116.19	4,658.21	7,149.60	8,687.20	9,636.00

[18] In nala tapping work, a parallel pipeline to nala is laid and wastewater of all the drains which are merging in to the nala/ river is diverted to STPs for treatment.

Particulars	Sewage generation due to water consumption by the citizens of ULBs				
	2016-17	**2017-18**	**2018-19**	**2019-20**	**2020-21**
No. of remaining households that have their own sources	20,250	17,000	15,000	13,000	10,436
Water consumption by the remaining houses from own sources (@ 135lpcd*5 members)	4,989	4,188	3,696	3,203	2,571
Sewage generation by households where water is not supplied by the ULB	3,991.28	3,350.70	2,956.50	2,562.30	2,056.94
Total sewage generated in ULB, Dewas	8,107.47	8,008.91	10,106.10	11,249.50	11,692.94
Treatment done through STPs of ULB, Dewas	STP was not constructed			336.34	576.36
Untreated sewer	8,107.47	8,008.91	10,106.10	10,913.16	11,116.58
Total wastewater which could not reach up to STPs of ULB, Dewas for treatment-2					**48,252.21**
Water supplied by ULB, Ujjain	30,523	29,648	31,960	34,518	37,961
Sewage generated during a year at 80% of supplied water	24,418.40	23,718.40	25,568.00	27,614.40	30,368.80
No. of remaining households that have their own sources	64,420	63,518	62,713	61,511	60,405
Water consumption by the remaining houses from own sources (@ 135lpcd*5 members)	15,871.48	15,649.25	15,450.92	15,154.77	14,882.28
Sewage generation by households where water is not supplied by the ULB	12,697.18	12,519.40	12,360.73	12,123.82	11,905.83
Total sewage generated in ULB, Ujjain	37,115.58	36,237.80	37,928.73	39,738.22	42,274.63
Treatment done through STPs of Ujjain	23,360.00	23,360.00	30,295.00	30,295.00	30,295.00
Untreated wastewater which could not reach up to STPs	13,755.58	12,877.80	7,633.73	9,443.22	11,979.63
Total wastewater which could not reach up to STPs of Ujjain for treatment-3					**55,690**
Grand Total (Total quantity of sewage that could not be treated in spite of availability of STPs) (1+2+3)					**4,24,632.82**

(Source: ULBs, Indore, Ujjain and Dewas)

It is evident from **Table 2.10** that during the period from 2016-17 to 2020-21, a total of 4,24,633 ML sewage was not treated in spite of having availability of STPs in ULBs, Indore, Dewas and Ujjain. Thus, due to the networking deficiency and leakages in sewerage network, the sewage did not reach the STPs and remained untreated. As a result, untreated sewage water flowed into Kahn and Kshipra Rivers. There were no STPs in other ULBs.

The UDHD, GoMP stated (January 2023) that in case of ULB, Ujjain, the 92.5 MLD STP under Phase 1 of AMRUT will cover eight nalas in Ujjain which will hold the sewage generated and remaining three nalas would be covered under AMRUT 2.0. The reply was silent about ULBs, Dewas and Indore.

2.3.2 Inappropriate work of Outfall/ Nala tapping against the scope of contract

Nala tapping/ Outfall Tapping work is done to prevent the merging of sewage waste in the rivers. In Indore, a parallel pipeline to nalas had been laid and wastewater of all the drains which were merging in the nalas/ river was diverted to STPs for treatment. While in Ujjain,

wastewater was pumped from the nalas and sent to Sadawal STP to prevent it from merging in the Kshipra River.

Nala Tapping at Indore- A sewage line on both side of river/nala is laid and all the outfall on both sides of river are connected to this sewerage line as shown in photographs below.

Image 2.8: Nala Tapping in Indore

Sewerage line manhole along both sides of Nala.

Nala Tapping at Ujjain- Sewage wastewater had been pumped from the pump houses and had been sent to wastewater stabilization pond STP at Sadawal for treatment.

Step-1

Diverted water of different nalas towards Sump well/Tank*.

Step-2

From tank, water is transferred to sumpwell of pumphouse.

Step-3

Water is pumped to STP for treatment.

* A sump well/tank is used to store water collected from nala which is then pumped to STP for treatment.

There are 28 major nalas in six ULBs which are merging in Kshipra and Kahn Rivers. It can be seen from **Table 2.11** that 11 out of 28 nalas were tapped by ULBs and the remaining 17 nalas were not tapped at all. Sewage waste with storm water[19] is merging in Kshipra and Kahn Rivers through these 17 nalas.

[19] Water that originates from precipitation (storm), including heavy rain and meltwater from hail and snow.

Table 2.11: Nalas in ULBs and their tapping status

S.N.	Name of ULBs	Total No. of nalas merging in Kshipra River	No. of nalas Tapped by ULBs	Number of Untapped nalas
1	Indore	6	3	3
2	Ujjain	11	8	3
3	Dewas	2	0	2
4	Mahidpur	2	0	2
5	Sanwer	6	0	6
6	Alot	1	0	1
Total		28	11	17

(Source: Information from the selected ULBs)

Out of the 11 tapped nalas, Audit observed that:

- Three[20] nalas which were being shown as tapped by ULB, Indore, had not been fully tapped[21].
- Eight nalas were tapped by ULB, Ujjain and the treatment of water in these nalas was being done by the method of multiple ponds22 as could be seen in Image 2.9. In six out of the eight nalas tapped by ULB, Ujjain, the system did not function effectively during the rainy season as water got filled in the pump houses of these nalas. Thus, due to the inefficient system of nala tapping in ULB, Ujjain, a significant quantity of water is being left untreated.

Image 2.9: Google Earth image of Sadawal multiple pond / WSP STP

In respect of the other four ULBs, there was no provision for nala tapping. Out of these, in case of Dewas, although the sewerage plan had been prepared, but the plan did not have any provision for nala tapping.

The UDHD, GoMP stated (January 2023) that all the households in ULB, Ujjain will be connected through sewerage network so that no sewage flows in the nearby nalas and no tapping will be required. All three nalas which merge into Kshipra River from ULB, Dewas

[20] Bhamori, Piliakhal, Palasia.

[21] There was a deficiency of 15 *per cent* nala tapping work in industrial area and 79 *per cent* in old city area.

[22] In this process, water is pumped from the nala onto a pond and thereafter the wastewater is transferred from one pond to several other ponds in a sequence which helps in natural cleaning and oxidation of impurities from the sewage.

get dry during non-monsoon season and a 10 MLD intake well in one big nala is being constructed to treat the sewage of the nala through 22 MLD STP for which the work is under progress. At ULB, Alot, no nala merges into Kshipra River as the River is six km away from the boundary of the ULB. In the ULB, Mahidpur, DPR has been prepared under NMCG/SBM 2.0 through which the nalas will be intercepted and treated before merging into the Kshipra. In ULB, Sanwer, no nala merges into Kshipra.

The reply was silent about ULB, Indore. However, during the audit, ULB, Indore stated (December 2021) that the 85 *per cent* nala tapping had been completed *vis-à-vis* the proposed work. The reply of ULB, Indore fails to explain the reasons for non-completion of the work as per targets and it was also silent on the estimated timelines for completion of the balance 15 *per cent* work. The reply about ULBs, Alot and Sanwer is factually incorrect as one nala was merging in Kshipra River from Alot and six nalas were merging in Kahn River in Sanwer.

The fact remains that at present, 17 untapped nalas continue to merge into Kshipra and Kahn Rivers which are continuously getting polluted.

2.3.3 ULBs not being able to provide adequate house connections

In three ULBs, house connections were provided only in 2,79,812 households out of total 6,01,669 households, which is 46.51 *per cent* of total households in these ULBs. Remaining three ULBs do not have the STPs.

Clause 2.11 of CPHEEO Manual, regarding Guidelines on house sewer connections, provides that:

- Amend the Municipal Byelaws to make it compulsory for the population to avail house service connection wherever public sewer is provided, otherwise, the local authority shall affect the house sewer connection and initiate revenue recovery proceedings.
- Include house-service sewer connections as part of the sewerage project itself.

Sewerage network and STPs have been constructed in three[23] out of total six ULBs. In these three ULBs, household connections were given the least priority. Total households and connected households with sewerage line are detailed in **Table 2.12**.

Table 2.12: Total households and connected households with sewerage line

S.N.	Name of ULBs	Total Households as on March 2021	Household connected to sewerage network	Household not connected to sewerage network
1	Indore	4,26,903	2,63,812	1,63,091
2	Ujjain[24]	1,22,766	0	1,22,766
3	Dewas	52,000	16,000	36,000
4	Total	**6,01,669**	**2,79,812**	**3,21,857**

(Source: Information from the selected ULBs)

Thus, out of total 6,01,669 households in three ULBs, house connections have been provided only to 2,79,812 households, which is 46.51 *per cent* of total households. It is pertinent to mention here that in Ujjain, no household is connected with sewerage network.

[23] Indore, Ujjain, Dewas.

[24] Sewerage network in Ujjain is not complete yet.

The UDHD, GoMP replied (January 2023) that 80,320 households will be connected under the ongoing sewerage project of AMRUT phase 1.

It was further noticed that:

- In ULB, Dewas, provision for providing house connection to individual houses from sewage trunk was made in DPR but the same was not included in the agreement. These 16,000 connections were provided to the consumers at their own expenses. Contractor had not provided any house connection as agreement was not in the consonance of the DPR.

  The ULB, Dewas stated (September 2021) that there was no provision in the agreement to connect houses to the main line of sewage chamber. Beneficiaries were required to connect their houses at their own expense by paying connection charges of ₹ 250 to the ULB.

  Reply of the ULB, Dewas is not acceptable because due to non-provision in the agreement, most of the individual households remained unconnected with the sewerage network.

- The provision of household connection was available in the DPR in ULB, Indore as per guidelines of the AMRUT with the aim of providing every household with sewerage connection. But it was not even included in the agreement (No. 05/2017-18) of construction, testing and commissioning of five STPs. Thus, the purpose of connecting each household with the sewerage network was not fulfilled.

  The ULB, Indore replied (December 2021) that according to the provisions, individual houses were connected through secondary sewerage lines.

  However, ULBs, Indore and Dewas had failed to provide house connections to all the households. Thus, in absence of connecting all households from the network, purpose of treatment of the sewage and abatement of pollution of water bodies were defeated.

2.3.4 Non-adherence of time schedule for completion of work as per milestones

Work of commissioning of sewerage network and STPs in three ULBs could not be completed as per timeline. In all three ULBs, work was delayed by more than two years. Other three ULBs did not have STPs.

As per Clause 15.1 of the general condition of contract, time allowed for carrying out the work shall be strictly observed by the contractor. Failure of the contractor to adhere to the timelines and/or milestones shall also attract Liquidated Damage (LD) at the rate of 0.05 *per cent* per day.

Scrutiny of the records of the four works at ULBs, Indore, Dewas and Ujjain revealed that contractors had failed to achieve milestones within the scheduled period. Due to the delay in completion of the works, the sewage treatment was consequentially delayed. Further, against the leviable maximum penalty of ₹ 67.25 crore for such abnormal delay, no action was initiated by ULBs, details are shown in **Table 2.13.**

Table 2.13: Details of non-levy of penalty due to abnormal delay

(₹ in crore)

S.N.	Agreement No. and date	Work	Scheduled completion date	Contract cost	Work executed			LD leviable 8 (7*4* 0.05 *per cent*)
					Cost	Percentage	Delay in days[25]	
	1	2	3	4	5	6	7	8
	ULB, Indore (up to November 2021)							
1	05/2017-18 28/12/2017	Construction, testing and commissioning of 5 Nos. STPs including ten years operation and maintenance of overall works.	28/10/2019	183.60	169.49	92.3	123	11.29
	ULB, Dewas (up to August 2021)							
2	22/12/2015	Design, Construction, of 3 No. STPs of 12 MLD, 14 MLD and 22 MLD capacity, providing, laying, jointing of sewerage line, *etc*. complete with operation and maintenance of 10 years.	12/4/2018	157.60	144.03	91.40	688	15.76
	ULB, Ujjain (up to May 2022)							
3	525/2017-18 dated 07/11/2017	Survey, Investigation, design, construction, testing and commissioning of sewerage network and sewerage treatment plant, including operation and maintenance for 10 years period.	07/11/2019	402.01	207.83	51.7	115	40.20
Total								**67.25**

In ULB, Ujjain, as of May 2022, only 50 *per cent of* work was completed. Therefore, a penalty at the rate of 10 *per cent* should have been levied.

Further, an amount of ₹ 2.25 crore, which was withheld on account of penalty for delay, was finally refunded to contractor on the ground of sanction (November 2021) of time extension up to 13 March 2022 by the Engineer-in Chief, UADD with a condition to withhold amount at the rate of three *per cent* from each running bill by reserving the right to levy the LD. This resulted in un-authorised refund of the amount by overriding contractual provisions and E-in-C orders.

The UDHD, GoMP replied (January 2023) that in ULB, Indore, time extension was granted to M/s LC Infra project from 18/01/2020 to 15/10/2021 and penalty of amount ₹ 13.72 lakh was imposed on contractor. In ULB, Dewas, penalty of ₹ 9.65 lakh was imposed and recovered from contractor. In ULB, Ujjain, work was delayed due to Covid-19 pandemic, lots of VVIP visits and lack of machinery and manpower.

Reply of the UDHD, GoMP was silent on the reasons for imposition of lesser amount of penalty. Moreover, documentary evidence regarding recovered amount and time extension case was not submitted with reply. Further, the reply of ULB, Ujjain is factually incorrect as scheduled completion was much before the incidence of COVID-19, *i.e.*, 2019. Hence, penalty

[25] Delay up to February 2020, *i.e.*, before the pandemic.

should have been imposed and recovered as per penalty clause of agreement.

2.3.5 Deficiencies in execution of works related to Sewerage Network

In ULB, Indore, sewerage network was not executed in the line with CPHEEO Manual and other specifications.

2.3.5.1 Irregular design of cross drainage work with gravity flow

Para 3.52 of Part-I of CPHEEO Manual for laying of sewerage pipeline projects stipulates that when cross drainage works arise on river course or nala, it shall be mandatorily implemented without fail as sewage water promotes algae growth which can eventually result in eutrophic "dead zones" where aquatic life cannot survive because of lack of oxygen as well as soil contamination is likely to occur which eventually pollutes groundwater.

Gravity sewers, if possible, may be converted to pumped sewer lines by low lift dedicated pumping stations, before the discharging into the gravity section and after crossing the water course, this will help in always keeping the pumped sewer visible or close to the ground.

Scrutiny of the DPR of construction of five STPs under AMRUT revealed that provision of sewage transmission at the crossings was made from the gravity system instead of providing pumping stations at regular intervals and on the crossings of drainage, nalas and rivers, *etc*.

During the site visit of sewerage network, leakages in manholes of sewerage pipelines at many stretches were noticed **(Images 2.10 and 2.11)** by the audit where river crossing was made through gravity.

Images No. 2.10 and 2.11: Showing leakage from the sewerage pipeline in the nala Crossing

(Source- Photos taken during Physical Verification at ULB, Indore)

From the **Images 2.10 and 2.11**, it could be seen that appropriate and efficient treatment could not be provided to sewage waste due to substandard execution of work, which will impact the sewerage network, pump house and STPs.

ULB, Indore stated (December 2021) that the work has been executed with gravity flow as per condition of the agreement. ULB, Indore accepted the facts of non-adherence of specification which has impacted the sewerage network.

2.3.5.2 Irregular acceptance of substandard work

Para 12.11.4, of IRC- 15, provides that the concrete represented by a core shall be considered acceptable if the average equivalent cube strength of the core is equal to at least 85 *per cent* of the characteristic compressive strength of the grade of concrete specified for the corresponding age as mentioned in Indian Standard 456-2000. However, the individual core shall not have strength less than 75 *per cent* of the characteristic strength of concrete in 5 *per cent* of the tests.

Further, as per the para 16.1 of the Indian Standard Code 456, the targeted mean compressive strength of Cement Concrete (CC) of M:20 and above grade, determined from any group of four consecutive test results, must exceed from the characteristic strength by at least 04 N/mm^2. Thus, minimum acceptable limit of mean compressive strength for Pavement Quality Concrete (PQC) M: 20 and M: 30 shall be 24 and 34 N/mm^2 (240 and 340 $kg/cm^{2)}$ respectively.

In Ujjain, for third party quality assurance, core tests of PQC M: 20 and M: 30 laid in road restoration were got tested by the NABL accredited labs. It was noticed that 20 results of M: 20 and 14 results of M: 30 PQC were below the acceptable limit (***Appendix 2.1)***. The AMRUT Engineers (SE, AE) and Consultant were responsible for accepting sub-standard work.

Further, IRC-15 provides (Para 12.30 and 12.31) that section whose thickness is deficient by 20 mm or more is identified with the help of cores. Such slabs shall be removed and reconstructed at the cost of the contractor. During such rectification work, care shall be taken to replace the full slab and to the full depth.

It was further noticed that in road restoration work of Ujjain sewerage project, thickness of M: 20 PQC in Shantinagar, Kachi Basti and M: 30 in Neelangana Road were entirely replaceable due to execution with thickness having negative variation more than 20 mm of

thickness. Thus, the aforesaid quantity of the area, costing ₹ 23.39 lakh,[26] was replaceable at contractor's cost.

The UDHD, GoMP replied (January 2023) in case of Ujjain that work had been strictly monitored by consultant WAPCOS Limited and engineers of ULB, Ujjain at site and regular testing of material was being done to ensure execution of work as per specification.

Reply is not acceptable as due to lack of monitoring by consultant WAPCOS Limited and engineers of ULB, Ujjain, substandard work was accepted by ULB, Ujjain. No action was taken by the Nigam after receipt of test results of such stretches.

For ULB, Indore, no reply had been submitted by the UDHD, GoMP.

In case of failure of road restoration work due to sub-standard work, functioning of sewerage line below road will be impacted. The Department may fix responsibility and take action against the erring officials for overseeing the execution of sub-standard work.

2.3.6 Ineffective management of Fund

Improper utilization of fund was observed in all three ULBs during execution of sewerage network and STPs.

As per Rule 9 of the Madhya Pradesh Financial Code, every Government servant who incurs or authorises the incurring of any expenditure from public funds is expected to exercise the same vigilance in respect of expenditure incurred from public money as a person of ordinary prudence would exercise in respect of expenditure of his own money.

Audit observed that in three out of the six ULBs, work related to sewerage network and STPs was executed without keeping financial propriety in mind. This led to improper utilization of available funds. Details in this regard are given in succeeding paragraphs.

2.3.6.1 Increase in cost due to award of work without availability of land

Madhya Pradesh Works Department Manual (Para 2.104) envisages that when the estimate has been sanctioned and funds allotted, an application for acquisition of land shall be sent to the Collector by the authorities and notification for the acquisition of land required for any particular work must be submitted before the work is put in hand.

In the work of construction of three STPs of total capacity of 48 MLD along with Design, Construction, Commissioning of sewerage network of ULB, Dewas, length of rising main[27] had increased from 1,900 m to 12,350 m due to change of location of 14 MLD STP. This resulted in extra cost of ₹ 8.28 crore ***(Appendix 2.2)*** due to selection of disputed land earlier.

ULB, Dewas stated (September 2021) that due to public protest, requisite area of land for pumping stations and STPs could not be taken in possession for execution of work.

The reply of the ULB, Dewas is not justified as before inviting tenders, land was to be acquired by them and by not doing so, there was an extra financial burden on the ULB.

2.3.6.2 Acceptance of bid without fulfilling the criteria

In the pre-qualification criteria (April 2017) of Ujjain sewerage project (₹ 367.53 crore), it was

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[26] ₹ 23,38,872 = ₹ 21,38,100 (M:20 - 300 Cu.M. x ₹ 4,778 = ₹ 14,33,400 + M:30 - 150 Cu.M. x ₹ 4,698 = ₹ 7,04,700) + ₹ 2,00,624 (9.383 *per cent of* 21,38,100 = ₹ 2,00,624).

[27] Pipeline through which sewage wastewater is pumped to STP for treatment.

clearly mentioned that the bidder should have successfully executed: a) three similar works costing not less than the amount equal to 20 *per cent* of the probable amount of contract during the last seven years; or two similar works costing not less than the amount equal to 30 *per cent* of the probable amount of contract during the last seven financial years; or one similar work costing not less than the amount equal to 50 *per cent* of the probable amount of contract during the last seven financial years.

In case of sewerage related works, similar works shall mean work related to sewerage project comprising of essentially the following components:

i) Providing, laying and jointing of sewer pipeline of any material of nature; and
ii) Construction of Sewage Treatment Plant (STP)/ Common Effluent Treatment Plant (CETP)/ Effluent Treatment Plant (ETP).
iii) Further, average annual construction turnover on the construction work should not be less than 50 *per cent* of the probable amount of contract during last five financial years, and bidder shall have positive net worth as per audited Balance Sheet of last financial year.

Scrutiny of the records revealed that seven bidders submitted online bids in response to the tender advertisement, out of which, two bidders did not submit technical bids.

Audit examined the tendering process and observed that the documents submitted by one of the bidder (M/s Tata Projects Ltd.) clearly indicated that the Firm had never executed any works related to construction of Sewerage network and Sewerage Treatment Plants in the past seven years. Thus, the Firm did not have experience in this field and its bid was liable to be rejected.

The Consultant hired to oversee the bid process, while evaluating the bid proposals (August 2017) also highlighted the fact that M/s Tata Projects Ltd. had more than the required turnover but had not undertaken any projects related to sewerage network and Treatments Plants during the previous seven years. However, the State Level Technical Committee (SLTC) constituted to oversee works being executed under AMRUT, headed by the Engineer-in-Chief, ignored the facts and selected M/s Tata Projects Ltd. on account of the fact that they were the lowest bidders. This resulted in undue favour and the selection of an unqualified bidder.

Due to selection of an unqualified and inexperienced firm for execution of a high value project, there were delays in execution of work (detailed in **Para 2.3.4**) as well as execution of sub-standard work (detailed in **Para 2.3.5.2**).

The ULB, Ujjain replied (June 2022) that as all the water supply projects are also a part of sewerage project as both of them are related to each other. Though the bidder had not done individual sewerage projects, they had been involved in water supply schemes. The SLTC accordingly decided to award the tender to Tata Projects Ltd. on the basis of financial evaluation.

The reply is misleading as there was clear cut condition of experience in the sewerage related works, *viz*., laying jointing of sewage pipeline of any material of nature; and Construction of STP/ CETP/ETP. Further, there was no evidence on record to prove that the Firm had executed any city wide water supply network projects. As such, selection of unqualified bidder impacted the execution of projects.

2.3.6.3 Extra cost due to deviation from DPR

DPR and agreement for execution of sewerage network of ULB, Dewas costing to ₹ 157.60 crore included entire area of 45 wards. However, the executed work was finalised after completion of sewerage network in 36 wards only instead of 45 wards, without recording any reason. Further, a new DPR, costing ₹ 61.80 crore was prepared by ULB, Dewas for the left-

over work of the remaining nine wards. Therefore, work was not executed according to the provisions of the DPR and this resulted in extra expenditure of ₹ 61.80 crore.

The ULB, Dewas replied (September 2021) that laying of sewer pipeline works in nine wards could not be executed due to larger distance from the city, keeping in view the land topography and increase in approved costs.

The reply of the ULB, Dewas is not acceptable as the fact remains that the Engineers (SE, AE) and the Consultant were responsible for incorrect planning. The Department's reply did not explain the reason for such faulty planning resulting in incurring of extra expenditure.

2.3.6.4 Excess payment to contractor without execution of work in ULB, Ujjain

The work of survey, investigation, design, construction, testing and commissioning of sewerage network and STP for Ujjain city costing ₹ 402.01 crore, was awarded to M/s Tata Projects Limited by ULB, Ujjain. Following issues related to excess payment were noticed by Audit:

➢ Excess payment due to considering wrong amount of previously paid amount

During scrutiny of the running bills, it was noticed that in the 3rd RA bill, cumulative amount of ₹ 23.29 crore was paid but in the 4th RA bill, previously paid amount was considered as ₹ 15.36 crore (amount of 2nd RA bill) instead of ₹ 23.29 crore and deduction was done accordingly. Similarly in the 7th RA bill, previously paid amount was recorded as ₹ 37.43 crore instead of ₹ 39.27 crore. This had resulted in overall excess payment of ₹ 96.87 lakh as shown in the **Table 2.14**.

Table 2.14: Excess payment due to considering wrong amount of previously paid amount

(Amount in ₹)

S. N.	RA bill No and Date	Amount Paid			Amount Payable		Excess payment (₹)
		Up to date Bill amount	Previously paid amount (-)	Amount paid in current bill	Previous amount of bill	Amount payable in current bill	
	1	2	3	4	5	6 (2-5)	7 (4-6)
1	1st, 24/8/2018	6,33,25,358	0	6,33,25,358	0	6,33,25,358	0
2	2nd, 30/10/2018	15,36,47,499	6,33,25,358	9,03,22,141	6,33,25,358	9,03,22,141	0
3	3rd, 20/12/2018	23,28,50,344	15,36,52,114	7,92,02,845	15,36,47,499	7,92,02,845	0
4	4th, 11/01/2019	22,33,86,064	15,36,52,114	6,97,33,950	23,28,50,344	(-)94,64,280	7,91,98,230
5	5th, 25/2/2019	39,27,14,759	32,08,16,132	7,18,98,629	23,28,50,344	15,98,64,415	(-) 8,79,65,786
6	6-7th, 27/3/2019	61,51,64,012	37,42,60,116	24,09,03,895	39,27,14,759	22,24,49,253	1,84,54,642
7	8th, 01/4/2019	69,44,17,658	61,51,64,012	7,92,53,646	61,51,64,012	7,92,53,646	0
Total				**69,46,40,464**		**68,49,53,378**	**₹ 96,87,086**

ULB, Ujjain replied (June 2022) that the RA bills will be checked again and if any discrepancies are observed, then excess payments will be deducted in forthcoming RA bills.

The reply of the ULB, Ujjain is not acceptable as mandatory checks were not exercised by them before making payment. Further, despite assurance no action had been intimated by the Department (December 2022).

However, the Consultant and Additional Commissioner, Finance and their Section were responsible for making excess payment due to dereliction in essential checking. The Department may fix responsibility on the erring officials for dereliction and act of omission

resulting in excess payment of ₹ 96.87 lakh.

- **Excess payment without execution of work**

In the BOQ of Sewerage Projects of Ujjain, an item for laying of 200/290 mm double wall corrugated (DWC) pipe was payable at ₹ 495/m. However, the item was executed with 200/250 mm pipe without specifying the revised rates and the Division continued to make running payments at the rate of ₹ 495/m. The issues pertaining to accounting and payments for this work are as follows:

An amount of ₹ one crore lump sum was added in the 22nd RA bill by mentioning 'provisional amount for 200/250 mm pipe', however, the corresponding effect of the same item was not reflected up to the 37th RA bill. Same was also not shown in the ledger payment to M/s Tata Projects Limited. In the absence of related RA bill entry for the lump sum payment made, Audit is unable to derive assurance that the amount was paid for any actually executed work.

ULB, Ujjain stated (June 2022) that the rate of 200/250 mm DWC pipe was not mentioned in original BOQ due to which, proportionate rate of ₹ 495/m was being paid up to revised BOQ. In the 22nd RA bill, rate of 200/250 mm was compared with sewerage project of Gwalior and the rate was decided as ₹ 576/m and up to 22nd RA bill, the difference was calculated at ₹10,67,27,256 and accordingly, ₹ one crore lump sum amount was released.

The reply is not acceptable as the revised rate was not adopted anywhere in the RA bills even after the Department finalized the rate. Audit observed that the Department continued to calculate the amount in subsequent RA bills (up to 37th RA bill) at ₹495/m. Thus, in the absence of correct recording/accounting of payments made, there was excess payment to the contractor to that extent. Further, in the absence of correct accounting of rates/payments to be made, the chance that in future such excess payments or accounting errors will continue, cannot be ruled out.

2.3.6.5 Payment for work not done in road restoration works

As per Road and Bridge SOR -2012 of UADD, an amount of ₹ 319 per Cu.M. and ₹ 335 per Cu.M in execution of M: 20, M: 30 PQC respectively and ₹ 190 per Cu.M. in Dry Lean Concrete (DLC) are recoverable, if electronic sensor paver is not used during laying and compaction. Similarly, in the execution of granular sub-base (GSB), ₹ 51 per Cu.M. is recoverable due to non-using of vibratory roller.

In Ujjain and Indore sewerage projects, it was observed that contractors have executed DLC, M:20, M:30 PQC and GSB without using required electric sensor paver/ vibratory roller in road restoration works but full amount was released. This resulted in excess payment of ₹ 3.35 crore to the contractors, as detailed in **Table 2.15.**

Table 2.15: Details of payment for work not done

(Quantity in Cu.M.)

S.N.	Item Description	Rate to be deducted (₹)	Quantity executed as per 37th RA bill	Excess payment (₹)	Quantity executed as per 57th RA bill	Excess payment (₹)
			Sewerage Project, Ujjain (M/s Tata Projects, Ltd.)		STP work Indore (M/s Laxmi Construction Ltd)	
1	Providing and laying of dry lean concrete	190	28,324.83	53,81,718	0	0
2	Providing and laying of CC M-20 nominal mix with 20 mm graded crushed stone aggregate.	319	40,013.53	1,27,64,316	11,059.91	35,28,112
3	Providing and laying of CC M-30 nominal mix with 20 mm graded crushed stone aggregate.	329	18,055.6	59,40,292	1,684.51	5,64,311
4	Providing and laying of Granular sub-base grading II.	51	41,976.7	21,40,812	0	0
5	Total			2,62,27,138		40,92,423
6	Add tender percentage	9.383		24,60,892	17.99	7,36,636
Gross Total (₹)			**2,86,88,030**		**48,29,059**	
Total excess payment (₹)			**3,35,17,089**			

The ULB, Ujjain and Indore accepted the facts and replied (June 2022) that recovery will be done from contractors. The reply is silent on the role of the consultant and engineer who were responsible for making excess payment. Further, report on recovery is awaited (December 2022).

2.3.6.5.1 Excess payment due to incorrect application of rates in CC M:20 road work

Road and Bridge SOR -2012 of UADD provides the execution of M:20 PQC without dowels bars in construction of cement concrete road at the rate of ₹ 4557 per Cu.M. However, in the BOQ of Ujjain sewerage project, laying of PQC was included at the rate of ₹ 4,778 per Cu.M. This item includes the work of laying plain cement concrete including centering and shuttering which is applicable in civil works and pertains to Integrated SOR for Water Supply, Sewerage. The contractor had executed 40,013.53 Cu.M. M:20 PQC in road restoration work and it was paid at the rate of ₹ 4,778 per Cu.M. instead of ₹ 4,557 per Cu.M. This has resulted in excess payment of ₹ 96,72,728[28], due to adoption of incorrect rates.

ULB, Ujjain replied (June 2022) that appropriate action will be taken after due checking. Final action has not been intimated (October 2022).

2.3.6.5.2 Irregular execution of Semi-Dense Bituminous Concrete over the cement concrete, resulting in extra expenditure

According to clause 508.01 of the Ministry of Road Transport and Highways (MORT&H) specification, Semi Dense Bituminous Concrete (SDBC) is used for wearing/binder and profile corrective courses in single or multiple layers on a previously prepared bituminous bound surface.

[28] CC 40,013.53 Cu.M. x ₹ 221 (4,778-4,557) + 9.383 *per cent* = ₹ 96,72,728.

Further, clause 602.1.1 of the MORT&H specification stipulates that Cement Concrete Pavement work shall consist of construction of unreinforced dowel jointed plain cement concrete pavement. This work shall include furnishing of all plant and equipment, materials and labour and performing all operations in connection with the work, as approved by the engineer.

From the above, it is clear that SDBC pavement and Cement Concrete Pavement both are complete items and no further layer is required to be laid over these pavements.

However, in contravention to MORT&H specification, in the road restoration work after execution of PQC M:20/ M:30, a layer of SDBC has been executed by applying prime/ tack coat. This has resulted in extra expenditure of ₹ 1,24,14,663[29] due to laying of superfluous item of SDBC over PQC.

ULB, Ujjain replied (June 2022) that it was decided in the meeting to restore the roads at the earliest with CC work. But, due to mismatching top surface in main roads, it was decided to get the top layer with 25 mm SDBC and balance with CC cross section.

The reply is not acceptable as restoration of road with even profile is responsibility of the contractor. Further, bituminous roads were also restored with CC, hence, profile of the roads should be maintained at contractor cost, if not found suitable

2.3.6.6 Non-utilisation of excavated GSB and WBM material

As per clause 1.8 of the specifications for sewerage related jobs, appended with the agreement, all surface materials suitable for reuse in restoring the surface shall be kept separate after general excavation, as directed by Engineer-in-Charge. Further, the DPR of sewerage project of Ujjain provides rates for cutting of Water Bound Macadam Road (Pipeline SOR) and making the same, including supply of extra quantities of material, *i.e.*, aggregate, moorum screening and labour, required at the rate of ₹ 693 per Cu.M. for the quantity of 29,906.2 Cu.M. However, in the BOQ, this item was replaced with laying of GSB Grading-II (Road SOR) at the rate of ₹ 614 per Cu.M. for filling work without utilisation of excavated material.

It was noticed that during execution, utilisation of excavated quantity was not considered and item of laying GSB for 39,577.81 Cu.M. was paid separately. This had resulted in extra cost of ₹ 2.01 crore[30] due to non-utilisation of excavated materials.

ULB, Ujjain replied (June 2022) that it is not possible to separate the material of GSB and WBM and it is mixed with black soil and hence not useful for restoration.

The reply is not acceptable as agreement and DPR provide for utilisation of excavated material. It is the responsibility of the contractor to separate the reusable material, failing which, cost of the same should be adjusted from his payment. The consultant and engineers were responsible for monitoring and to ensure utilisation of the excavated material in restoration work.

2.3.6.7 Excess payment due to incorrect adoption of rates of non-BOQ items

Clause 21.1 (b to d), under the payment for variations or extra quantity, provides that if the item is not in the priced BOQ and included in the SOR of the Department, the rate shall be arrived at by the applying quoted tender percentage on the SOR rate. If the rates of altered/ substituted items are not provided in the applicable SOR, such rates will be derived from rates for a similar type of work as is provided in the contract (priced BOQ) for the work. Further, if

[29] ₹ 10,25,618 (Tack coat 39,446.86 sq m x ₹ 26) + ₹ 103,24,101 (SDBC 1,319.88 Cu.M. at the rate of ₹ 7,822) = ₹ 1,13,49,719 + 9.383 % contractor premium = ₹ 1,24,14,663.

[30] ₹ 2,00,85,351 (utilisable quantity as per DPR 29,906.2 Cu.M. x ₹ 614 + 9.383 *per cent)*.

the rates for the altered, substituted work can't be determined in the manner mentioned aforesaid, then the rates for such composite work shall be worked out on the basis of concerned schedule of rates minus/plus the rates quoted by the contractor.

In the 2nd revision (March 2022) of BOQ by the Chief Engineer, UADD rate for providing and laying of 250 mm and 300 mm DWC/HDPE pipes had been taken from the PHED SOR, 2016 at ₹ 968 per m and ₹ 1410 per m respectively, while rates of the similar items were available in UADD SOR at ₹ 767 per m and ₹ 1287 per m. Thus, incorrect adoption of rates of PHED instead of UADD SOR has resulted in excess payment of ₹ 15,51,771 as detailed in ***Appendix 2.3.***

The ULB, Ujjain accepted the facts and stated (June 2022) that recovery will be done after checking.

Further progress has not been intimated (October 2022).

2.3.6.8 Irregular inclusion of maintenance cost in the operation and maintenance during defect liability period

In the agreements of the works, construction of sewerage projects of Ujjain and construction of five STPs at Indore, it was stipulated that after successful completion of the project, the bidder had to cover all the defects in the work up to the defect liability period of five years after completion of capital work and 10 years of operation and maintenance period shall include the five years defect liability period. Thus, payment of maintenance for the initial period of five years which was also defect liability period should not be payable.

It was, however, noticed that contrary to aforesaid conditions, an amount of ₹ 387.38 lakh and ₹ 94.50 lakh were included as maintenance cost for first five years in the sewerage work of Ujjain and Indore respectively. This resulted in irregular inclusion of maintenance cost of ₹ 481.88 lakh during the defect liability period, as detailed in **Table 2.16**.

Table 2.16: Details of cost of maintenance included in the operation and maintenance during defect liability period

(₹ in lakh)

S.N.	Name of Work	Agreement No.	Amount
1	Construction of five STPs, pump houses and laying of sewerage network, *etc*.	05/2017-18	94.50
2	Construction of 92 MLD STP and laying of sewerage network, *etc*.	525/2017-18	387.38
Total			**481.88**

ULBs, Ujjain and Indore accepted the facts and replied (June 2022) that it would be modified during the operation and maintenance.

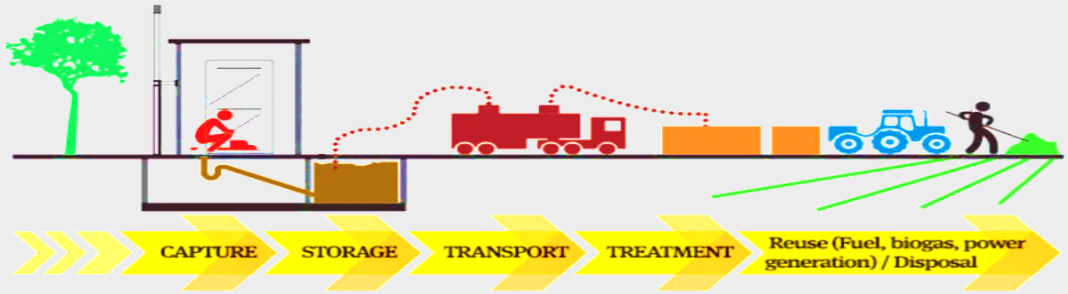
Further progress has not been intimated (October 2022).

Conclusion: *The Minor Hypothesis was observed to be true. Test check of records including physical verification (substantiated by photographs) revealed that the ULBs, in spite of availability of treatment capacity, could not treat sewage due to inappropriate sewerage network. Nala Tapping works were not executed properly and sewerage connections were provided to only 47 per cent of the households. The sewerage network and STP works could not be completed as per timelines. Furt her, there were excess payments which indicated lack of oversight in the entire process.*

2.4 Minor Hypothesis No-3: Urban Local Bodies/Panchayat Raj Institutions are not managing the Faecal Sludge appropriately.

Faecal Sludge is raw or partially digested, in slurry or semisolid form, the collection, storage or treatment of combinations of excreta and black water, with or without grey water. It is the solid or settled contents of pit latrines and septic tanks. The effluents from the septic tank can be collected in a network of drains and/or sewers and treated in a treatment plant designed appropriately. The accumulating sludge at the bottom of the septic tanks, however, must be removed also and treated once it has reached the designed depth or at the end of the designed de-sludging frequency whichever occurs earlier. However, such a removal is possible only by vacuum emptier trucks. Procedure of collection and treatment of faecal sludge is depicted in the following image:

Image 2.12: Showing the procedure of collection, transportation and treatment



(Image Source: Ministry of Urban Development, GoI)

The hypothesis was checked at ULB level through various aspects, *i.e.*, strategy for Faecal Sludge and Septage Management (FSSM), collection, transport, treatment, monitoring of faecal sludge generation and disposal, *etc*.

Findings on above are discussed in detail in succeeding Paragraphs:

2.4.1 Lack of proper strategy for Faecal Sludge and Septage Management in ULBs

Out of total six, five ULBs had not prepared any faecal sludge septage management policy.

GoMP State Level Policy (2017) for Wastewater Recycle and Reuse and FSSM states that prime responsibility for installing and operating a sanitation service lies with the individual Municipal Bodies. Each ULB should determine its own policy for a sanitation service at the micro level within the framework of the guidelines established in the macro policy formulated by the State Government.

Audit observed that out of selected six ULBs, five[31] had not prepared any FSSM Policy. In these ULBs, wastewater from the kitchen and bathrooms and from the outflow of septic tanks flows in open drains which ultimately merges in Kshipra and Kahn Rivers. This condition is

[31] Mahidpur, Sanwer, Alot, Ujjain and Dewas.

only due to lack of proper strategy for safe disposal of septage under jurisdiction of these ULBs.

The ULBs had accepted the facts of non-preparation of FSSM policy, however, the replies of ULBs do not account for not formulating the Policy for a sanitation service at the micro level. Further, no strategy for safe disposal of faecal sludge was formulated in the ULBs.

The UDHD, GoMP replied (January 2023) that ULB, Ujjain is working on Faecal Sludge and Septage management at micro level for collection, transportation, treatment and disposal. However, no documentary evidence in support of the statement was provided by GoMP.

2.4.2 Improper collection, transportation and disposal of faecal sludge and septage

Out of total six ULBs, no ULB had proper system of collection, transportation and disposal of Faecal Sludge and Septage.

➢ Inadequate de-sludging of septic tanks/ collection of septage

Cleaning of septic tanks is done only when a tank gets clogged and filled beyond its holding capacity that means de-sludging is required. The most satisfactory method of sludge removal is by vacuum tank. When de-sludging is not done at regular intervals[32], the overflow from the tanks finds its way into any nearest waterways or land surface and pollutes it.

Audit observed that no tracking mechanism was developed by ULBs for cleaning of septic tanks as septic tanks were cleaned only when an application is received from concerned household entity. The number of septic tanks cleaned in the last five years in selected six ULBs is detailed in **Table 2.17**. Out of total 3,01,098 septic tanks in six ULBs, only 10,481 were de-sludged in last five years and remaining 2,90,617 septic tanks were never cleaned during the same period. Further, in the case of ULBs, Alot, Mahidpur and Sanwer, septage cleaning rate was almost nil, though 15,887 septic tanks existed in these ULBs.

➢ Non-availability of transporting mechanism

As per the Clause 4.8.1 of GoMP State Level Policy (2017) for Wastewater Recycle and Reuse and FSSM, septage transportation is one of the most important components of septage management. In fact, de-sludging trucks act as a 'mobile sewer network' for onsite sanitation systems.

Audit observed improper management of de-sludging vehicles in three[33] out of six ULBs test checked. The number of de-sludging vehicles and their working condition in above mentioned ULBs are detailed in **Table 2.17**.

Table 2.17: Details of septic tanks, de-sludging and availability of vehicles and their status

S.N.	Name of ULB	Total No. of septic tanks in ULBs	No. of de-sludging vehicles	Status of de-sludging vehicles in last five years	No of households de-sludged in last five years
1	Indore	1,07,445	3	Working since last five years.	634
2	Ujjain	1,22,766	6	Four vehicles were working since last five years and two vehicles were	4,039

[32] Once in three years.

[33] Alot, Mahidpur, Sanwer.

				purchased in 2021.	
3	Dewas	55,000	2	Working since last 5 years.	5,795
4	Alot	7,145	1	De-sludging Vehicle was available since last five years but only cleaned three septic tanks.	03
5	Mahidpur	5,724	1	Purchased in 2019 but not in working condition since purchase.	00
6	Sanwer	3,018	1	Purchased in 2021.	10
Total		**3,01,098**	**14**		**10,481**

(Source: Information from the selected ULBs)

In ULB, Alot, de-sludging vehicle is available but it was utilized only three times. In ULB, Mahidpur, there was no de-sludging vehicle up to February 2019. Further, since its purchase in February 2019, it was not used at all. In ULB, Sanwer, de-sludging vehicle was purchased in 2021 only and since then, only 10 septic tanks were de-sludged.

➢ Improper disposal of Septage

As per clause 3.4 of Primer of FSSM, Faecal Sludge should not be discharged into surface waters or be treated like wastewater because its pollutant concentrations are very high. It cannot be used for direct land disposal or treated like solid waste because it is very high in moisture content. It cannot be directly used for crop fertilising because its pathogen content is very high. Faecal sludge treatment, therefore, requires a separate process.

Further, as per order issued (September 2018) by UADD, a Faecal Sludge Treatment Plant (FSTP) should be established for proper disposal of faecal sludge. Further, as per clause 4.12.4 of Madhya Pradesh State Level Policy (2017) for Wastewater Recycle and Reuse and FSSM, there are a number of treatment options like waste stabilization ponds, unplanted sludge drying beds, constructed wetlands, and composting.

However, in three[34] out of six ULBs, the treatment facility of faecal sludge was not available (March 2022). Treatment facility and service provided in selected ULBs are detailed in **Table 2.18**.

Table 2.18: Details of treatment facility in selected ULBs

S.N.	Name of ULB	Treatment facility	Status of treatment facility	No of households de-sludged in last five years
1	Indore	245 MLD treatment plant at Kabitkhedi	No separate facility was developed. Treatment of Faecal Sludge is done at 245 MLD STP.	634
2	Ujjain	FSTP plant at Surasa and Sadawal	Started working from 2020.	4,039
3	Dewas	At 12 MLD STP Medaki	Started working only after May 2020.	5,795
4	Alot	FSTP	FSTP under construction.	3
5	Mahidpur	FSTP	FSTP construction was completed in November 2020, but Vacuum Emptier Machine was not functional since purchase.	0
6	Sanwer	FSTP	FSTP was under construction.	10
Total				**10,481**

(Source: Information from the selected ULBs)

[34] Alot, Mahidpur, Sanwer.

Thus, except in the ULB, Indore, no other ULB had a working facility for treatment of generated faecal sludge up to 2020. Therefore, overflow from the septic tanks would be flowing into the nearby nalas though street drains which ultimately merge into Rivers (Kshipra and Kahn), besides polluting the groundwater.

Audit further noticed following deficiencies:

- In ULB, Alot, the collected septic is thrown away without any treatment due to non-availability of FSTP, which is hazardous for the environment.
- In ULB, Sanwer, the septage was being disposed at Pipalghat at Katkiya River (Tributary of Kahn River) as up to March 2022, FSTP was not available.
- In ULB, Indore, the de-sludging vehicles were unloaded at decanting point of 245 MLD STP situated at Kabitkhedi having co-treatment facility for treating septage along with the sewage. Three vehicles[35] had been deployed for de-sludging. However, no entries of the assigned vehicles were found at 245 MLD Kabitkhedi. So, there is a need to prepare a database of their disposal of septage, as mentioned in the succeeding **paragraph 2.4.3.**
- In ULB, Ujjain, only 4,039 septic tanks were cleaned out of total 1,22,766 households in last five years from 2016-17 to 2020-21. This was very less as compared to laid down norms which stated that every septic tank should be cleaned once in three years.

The UDHD, GoMP replied (January 2023) that in the ULBs, Alot, Sanwer, Mahidpur, Dewas and Ujjain, faecal sludge treatment plants had now been completed and fully operational.

The fact remains that during the period 2016-17 to 2020-21, lesser number of septic tanks were cleaned by respective ULBs. Due to non-functioning of FSTPs, treatment of septage was not up to the mark. This had impacted water bodies and groundwater.

2.4.3 Non-maintenance of records related to faecal sludge and improper monitoring

Out of total test checked six ULBs, no ULB had maintained database/ proper records, except ULB, Indore for monitoring of Faecal Sludge and Septage Management.

➢ **Non-Maintenance of Records**

As per the National Policy on FSSM, proper record keeping is necessary for proper implementation of the FSSM policy. The records may include the number of septic tanks with address, numbers of households with septic tanks, date of last cleaning of septic tanks and log-book at treatment plant regarding de-sludging vehicles.

Further, the Standard Operating Procedure (SOP) for cleaning of sewers and septic tanks envisages that final report shall also be entered in the computer in the ULBs so as to provide a database and to also know about the next emptying date, *etc*.

Status of maintenance of records at ULBs is mentioned in **Table 2.19**.

[35] MP09-GG-5674, MP10-AB-8246 and MP09-KD-7816.

Table 2.19: Details regarding status of maintenance of records at ULBs

S.N.	Name of ULB	Records of total number of septic tanks with address	Records of number of households with septic tanks as per Bhumi Vikas Adhiniyam	Records of last cleaning of septic tank	Records related to entry in logbook at treatment plant
1	Indore	✓	✓	✓	✗
2	Ujjain	✗	✗	✗	✓
3	Dewas	✓	✗	✗	✗
4	Alot	✗	✗	✗	✗
5	Mahidpur	✓	✓	✗	✗
6	Sanwer	✗	✗	✗	✗

(Source: Information from the selected ULBs)

Audit noticed non-maintenance of computerised database by the selected ULBs except Indore. Further, all the required records were not maintained properly by the audited ULBs, resulting in poor monitoring of the implementation of the FSSM. Further, observations are discussed in the following paragraphs.

➢ Deficient monitoring and evaluation of FSSM

As per National Policy on FSSM, households should also be encouraged to have a regular desludging schedule and this too should be monitored by the municipal/urban local bodies through a systematic monitoring system.

As per NITI Aayog's guideline on FSSM in Urban Areas, to ensure efficient and accountable desludging operations, GPS based vehicle tracking and monitoring systems should be deployed. This ensures real time monitoring of operations on the ground.

Monitoring of FSSM process in ULBs through use of technology is detailed in **Table 2.20**.

Table 2.20: Status of monitoring of FSSM in ULBs through use of technology

S.N.	Name of ULB	Geo-tagging of septic tank	GPS enabled de-sludging vehicles	Geo –fencing for de-sludging vehicles
1	Indore	✓	✓	✗
2	Ujjain	✗	✓	✗
3	Dewas	✗	✓	✗
4	Alot	✗	✓	✗
5	Mahidpur	✓	✓	✗
6	Sanwer	✗	✓	✗

(Source: Information from the selected ULBs)

It can be seen from the table that Geo-tagging of de-sludging vehicle was not done by four ULBs out of the selected six ULBs and Geo-fencing was not done by any of the ULBs.

The UDHD, GoMP replied (January 2023) that in case of ULB, Ujjain, records are being maintained and monitored for FSSM after the Audit observation. ULB, Indore replied (December 2021) that maximum three septic tanks are desludged in one day and three vehicles are available for this purpose. So, there is no need to assign Geo-fencing in the desludging vehicles.

The reply is not acceptable because in absence of route mapping, tracking of the desludging vehicle is not possible. Further, there was no inventory of received faecal sludge in the 245 MLD STP where faecal sludge is to be desludged.

The CMOs of Mahidpur, Sanwer and Alot replied (March/April 2022) that vacuum suction machine was being operated through tractor/truck and GPS has been enabled in the tractor/truck. However, the fact remains that Geo-fencing[36] was not done by any of the ULBs and four ULBs had not done Geo-tagging.

2.4.4 Non-existence of faecal sludge management in the Gram Panchayats

As per information provided by PRIs, there were 48,725 individuals and 99 community toilets available in the 212 villages along the Kshipra and Kahn Rivers. There were no FSTPs in any of these villages. Faecal sludge cleaning vehicles were available only in 63 villages of Indore. In absence of any treatment facility, proper disposal of generated septage is not possible in these 63 villages.

Thus, none of the 212 villages had any proper faecal sludge and septage management facility. In absence of such facility, untreated septage will directly/indirectly have an impact on Kshipra and Kahn Rivers and it will pollute groundwater as well.

***Conclusion**: The Minor Hypothesis was mostly true. As the ULBs, except Indore, were not having their own FSSM Policy. Proper system of collection, transportation and disposal of Faecal Sludge and Septage, along with proper database/records for monitoring of faecal sludge and septage is also absent. Further, there was no mechanism for faecal sludge and septage treatment in PRIs.*

2.5 Minor Hypothesis No-4: STPs have not been built and if built, are not working optimally

STPs are constructed to treat sewage generated from the cities. Effective and optimally working STPs reduce the risk of pollution in water bodies, which can be ensured through adoption of proper technology for STPs and analyses of test results of various parameters of treated water.

The hypothesis was checked at ULB level through various aspects, *i.e.*, construction of STPs as per approved design and manual, working of STPs, power arrangements and fixing of user charges, *etc*.

Findings on above are discussed in succeeding paragraphs.

2.5.1 Non-construction of STPs as per approved design and as per Sewerage Manual

Out of 12 major STPs, SBR technology is being used in nine STPs, which is effective, efficient and economical. Remaining three STPs were working on older technologies.

There are several newer treatment technologies that have come into practice in recent times, and they do merit attention in their own way, but the difficulty is design concept which is necessary to be standardized for adoption in projects funded by Governments. In general sense,

[36] Geo-fencing is a location-based service in which an app or other software program uses radio frequency identification, Wi-Fi, GPS, or cellular data.

technology adopted for treatment of sewage should be such that it entails relatively less establishment cost, good treatment for major parameters and relatively less operation and maintenance cost. Some of the relatively better-known technologies are mentioned below.

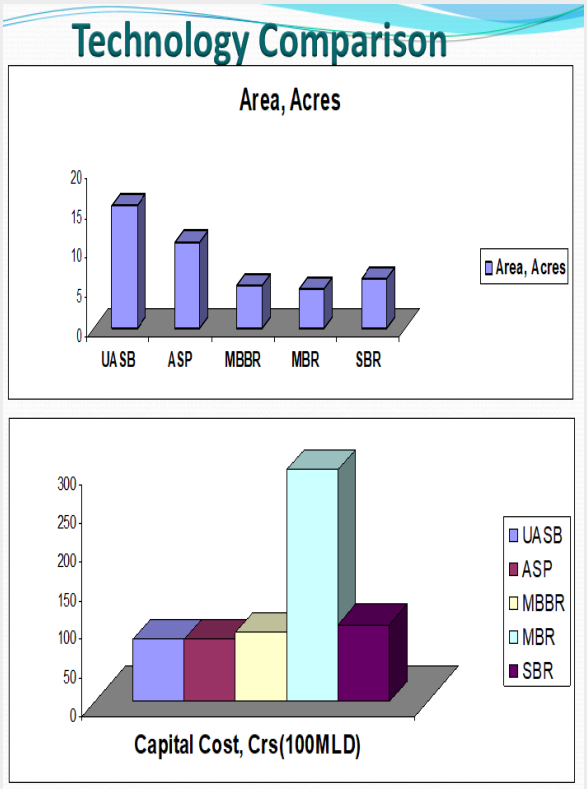
- Sequencing Batch Reactor (SBR)
- Moving Bed Bio Reactor (MBBR) / Fluidized Aerobic Bioreactor (FAB)
- Membrane Bio Reactor (MBR)
- Activated Sludge Process (ASP)
- Up-flow Anaerobic Sludge Blanket (UASB) Reactor

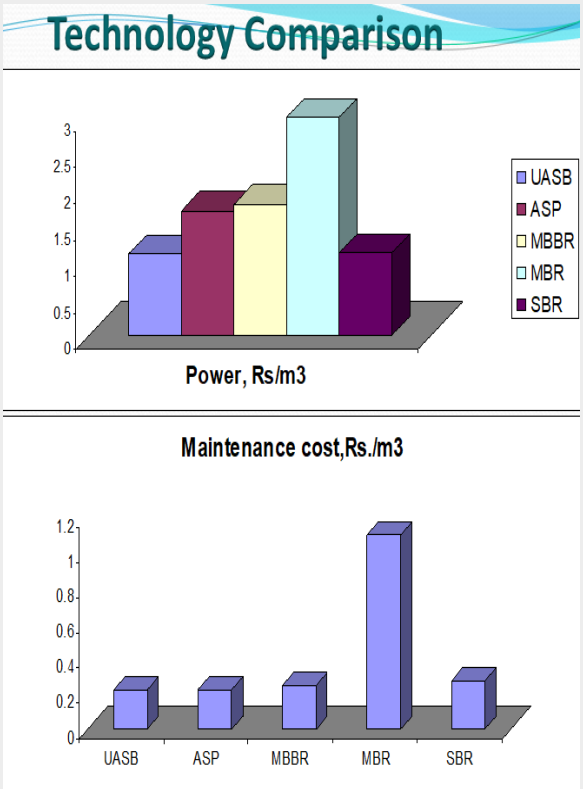
A comparative analysis of above-mentioned technologies regarding capital cost, operation and maintenance and treatment facility is detailed in the **Table 2.21**.

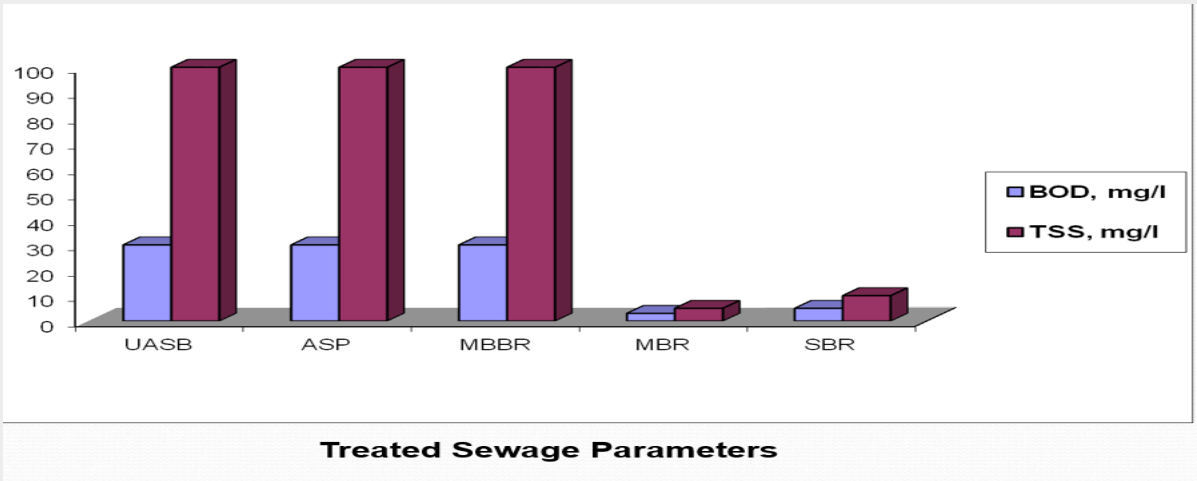
Table 2.21: Comparative analysis technologies regarding treatment of sewage

S.N.	Parameter	UASB+EA	ASP-EA	MBBR	MBR	SBR
1	BOD, mg/l	<30	<30	<20-30	<3-<5	<5
2	COD, mg/l	<250	<250	<250	<100	<100
3	TSS, mg/l	<100	<100	<100	<5	<10
4	TKN and P, mg/l	No treatment	No treatment	No treatment	No treatment	<10 and <2
5	Area (in Acres)	15.6	10.9	5.5	5	6.3
6	Capital Cost, ₹ in Lakh (100 MLD)	6,500	6,000	7,000	25,000	8,000
7	Power cost, ₹ /m^3	1.11	1.71	1.8	3.0	1.14
8	Chemical Cost	0.07	0.07	0.07	0.50	0.06
9	Maintenance cost, ₹ /m^3	0.22	0.22	0.25	1.1	0.27
10	Power generation	Yes	Nil	NIL	Nil	Nil

(Source: ULB Indore)







(Source: Indore Nagar Nigam)

Hence, it is clear that SBR technology is comparatively better for ULBs in view of capital cost, operation and maintenance and treatment quality.

Audit observed that out of 12 major STPs currently working in three ULBs, SBR technology was being used in nine STPs. Remaining three[37] STPs were using very old technology for treatment. Details regarding construction year, shortcomings and impacts are mentioned in **Table 2.22**.

Table 2.22: Details regarding construction year, shortcomings and impacts due to use of older technology

S.N.	Name of STP	Year of Construction/ Technology used	Shortcomings in technology	Impact assessment
1	78 and 12 MLD STP at Kabitkhedi Indore	2004/ UASB Reactor	Major parameters after treatment are higher than acceptable limit.	Huge quantity of wastewater is merging in Kahn River without proper treatment.
2	83 MLD STP at Sadawal, Ujjain	2002-03/ Waste-water stabilization pond system.	Major parameters after treatment are higher than acceptable limit.	Huge quantity of wastewater is merging in Kshipra River through Kahn diversion without proper treatment.

(Source: Information from the selected ULBs)

ULBs, Indore and Ujjain were still using outdated technology which is not able to treat sewage wastewater properly. Due to this, huge quantity of wastewater was merging in Kshipra River without proper treatment.

The UDHD, GoMP replied (January 2023) in case of ULB, Indore that DPR for up gradation of 78 and 12 MLD STP has already been approved by concerned authority. However, no reply was submitted for 83 MLD STP at Ujjain.

[37] 78 and 12 MLD STPs in Indore ULB are based on UASB technology and 83 MLD STP in Ujjain is based on wastewater stabilisation pond system.

2.5.2 Improper working of STPs and non-testing of major parameters

In ULBs, Indore and Ujjain, prescribed tests were not found to be conducted and some major water quality parameters were not within the prescribed limits. Remaining three ULBs do not have STPs.

➢ Prescribed tests not being conducted

In ULB, Indore, as per general instruction for operation and maintenance of 245 MLD STP, the contractor or operation and maintenance operator shall conduct the composite/random sampling for testing of required parameters as per norms and as and when required by the employer or regulating authorities, *i.e.*, MPPCB. It should be done regularly at site laboratory by chemist deployed. Minimum numbers and frequencies of parameters of tests to be conducted by the operation and maintenance operator during operation and maintenance period are also mentioned in instruction.

Audit observed that prescribed number of tests and frequencies were not followed by operation and maintenance operator. Details regarding number of tests to be conducted and number of tests actually conducted are mentioned in the **Table 2.23**.

Table 2.23: Details of tests to be conducted and actually conducted in Indore

S.N.	Name of tests / Parameters	Frequency of test to be conducted	Tests actually conducted at 245 MLD STP
1	COD	Daily	Conducted as per frequency
2	BOD	Daily	Conducted as per frequency
3	Total Suspended Solid (TSS)	Daily	Conducted as per frequency
4	VSS	Daily	Not conducted as per frequency
5	Alkalinity	Daily	Not conducted as per frequency
6	Sulphide	Daily	Not conducted as per frequency
7	Total Nitrogen and Ammonical nitrogen	Weekly	Not conducted as per frequency
8	Sludge profile	Weekly	Not conducted as per frequency
9	Faecal Coliform	Weekly	Not conducted as per frequency
10	MLSS (Mixed Liquor Suspended Solid	Three times in a week	Not conducted as per frequency

(Source: ULB, Indore)

The ULB, Indore stated (December 2021) that instructions were issued to contractors to perform the tests as per provisions. If they fail to perform the tests, necessary action will be taken. Further progress has not been intimated (December 2022)

In ULB, Ujjain, as per the consent of the MPPCB for 83 MLD STP, faecal coliform and total dissolved solids were to be tested regularly to achieve prescribed standards. Audit observed that in the test report of 2018-19 and 2020-21, faecal coliform and total dissolved solids were not being tested. Further, test reports for remaining years were not made available by the ULB. In absence of test reports of various parameters, quality of treated water to the acceptable level cannot be ascertained by the ULBs.

ULB, Ujjain replied (June 2022) that the facility for testing of faecal coliform and dissolved oxygen is not available in the departmental lab. A new laboratory along with 92 MLD STP is under construction for testing essential parameters. The reply is not acceptable as these essential tests should have been carried out from outside laboratories, if the testing facilities was not available in the departmental laboratories.

➢ Major indicators were above prescribed limits

MPPCB in its CTO for STPs had provided prescribed limit of major indicators, *i.e.*, Biological Oxygen Demand (BOD) for each STP.

Audit observed in 245 MLD, 78 MLD, 12 MLD STPs in Indore and 83 MLD STP of Ujjain that BOD level in STPs ranged above the limit as prescribed in consent letter. However, no action was taken by MPPCB and ULB (Indore and Ujjain) against the operation and maintenance operator.

ULB, Indore replied (December 2021) that in general, BOD can be determined by the 5th day after the sampling of raw/treated water but sometimes due to early testing (BOD) of raw/treated water, said value of BOD may vary. The reply of the ULB, Indore is not justifiable as the tests were conducted by them only.

ULB, Ujjain replied (June 2022) that at times, excess sewage water enters in the STP than the capacity, due to which the range of BOD and COD is found above the acceptable limit. Now, work of new STP under AMRUT is in progress and after completion, range of BOD and COD will be as per standard.

Further, Audit collected samples from five STPs of three ULBs and the same was tested by IIT Indore and it was observed that DO and BOD in STPs were beyond the acceptable limits. This is discussed in detail in **Chapter -3 (Paragraph 3.6.2).**

2.5.3 Non-provision of alternative power source at STPs

Alternative power source was not available in three out of 10 STPs in Indore and all three STPs in Dewas as well as in any pumping station of ULBs, Dewas, Indore and Ujjain. There were no STPs in remaining three ULBs.

As per consent provided by MPPCB, alternative power arrangement is necessary in case of power failure in STP as well as in pumping stations. The sewage of ULBs is routed through sewerage line laid in the cities which carries it to the pumping stations. From pumping stations, it goes to the STPs. For continued treatment of the sewage, alternative arrangement of power, *i.e.*, Diesel Generator (DG) set should have been made in the STPs and pumping stations in case of electricity failure/ power cut.

However, out of the 13 operational STPs (Indore-10, Dewas-three), DG Sets were not installed in six STPs (Indore- three, Dewas-three). Further, DG sets at all pumping stations of ULBs, Indore, Dewas and Ujjain were also not installed. Hence, in case of electricity failure/ power cut, the working of STPs may stop, which may also hamper the process of treatment of sewerage. Further, the CPHEEO Sewerage Manual (Paragraph 6.3) also advocates installation of DG sets in the STPs to keep them functioning without hindrance even in the event of unexpected power cut from the power company.

The UDHD, GoMP replied (January 2023) in case of ULB, Dewas that due to availability of 24 hours power supply, provision of alternative power source was not made. In case of ULB, Indore, the UDHD, GoMP stated (January 2023) that provision for alternate power source is under process in 3 STPs as pointed out by Audit.

Reply is not acceptable because of provision alternate power source is mandatory as per consent

condition of MPPCB and CPHEEO manual to keep the functioning of STPs without hindrance and to avoid merging of untreated wastewater in nearby water bodies in case of sudden power failure.

The reply of UDHD, GoMP was silent in case of ULB, Ujjain.

2.5.4 Underutilization of STPs

In ULB, Dewas, STPs were working only with 9.89 *per cent* of available total capacity.

The treatment capacity of the STPs in the three ULBs out of six was checked and it was observed that three STPs in ULB, Dewas were not being utilised to the full capacity while STPs at ULBs, Indore and Ujjain were working as per capacity. The other three ULBs did not have any STPs.

Sewage treatment capacity for the ULB, Dewas was 48 MLD. In the test check of data via SCADA system for the month of July 2021, the quantity of total treated sewage was around 1,47,212 Cu m, *i.e.*, 9.89 *per cent* of total available monthly capacity of 14,88,000 Cu m as detailed in **Table 2.24.**

Table 2.24: Details of under utilisation of STPs in July 2021

S.N.	STP	Treatment capacity (MLD)	Treatment capacity for the month (In ML)	Treatment capacity of July (In Cu m)	Actual treatment for July 2021 (In Cu m)	Utilization percentage
1	STP at Zone-1	12	372	3,72,000	56,918	15.30
2	STP at Zone-2	14	434	4,34,000	40,521	9.33
3	STP at Zone-3	22	682	6,82,000	49,773	7.29
Total		**48**	**1,488**	**14,88,000**	**1,47,212**	**9.89**

(Source: Information from ULB, Dewas)

It can be seen from the table above that only 9.89 *per cent* of the capacity was utilized by the ULB, Dewas.

The ULB, Dewas stated (September 2021) that 48 MLD capacity will be utilised only after 30 years. However, as per the projected sewage generation (40.58 MLD as of 2021, referred to in the Paragraph 2.1.1.2), STPs should be utilising 84.55 *per cent* of total capacity.

2.5.5 Inappropriate provision for utilization of treated effluents

None of the ULBs having STPs had made sufficient provision for reuse of treated effluents and the same was merging into nearby water bodies against the consent conditions.

According to the CTO issued by the MPPCB, the sewage shall be treated up to prescribed standards, properly disinfected and shall be reused for green belt development/ gardening/ agriculture in the areas, which are away from the nearby natural water bodies so that treated sewage application does not cause any adverse impact on the riverine ecosystem and environment in general.

Utilization of treated effluents at STPs of three ULBs are detailed in **Table 2.25**. There were no STPs in other three[38] ULBs.

Table 2.25: Status of utilization of treated effluents

S.N.	Name of STPs	Provision for reuse being made	Discharged in open drains near by	Utilized in Agriculture/ gardening
1	245 MLD STP at Kabitkhedi Indore	Provision of reuse of 13 MLD treated water being made	Yes	Yes
2	67 MLD STPs at Indore	No Provision in DPR	Yes	Yes
3	48 MLD STPs at Dewas	No Provision in DPR	Yes	Yes
4	83 MLD STPs at Ujjain	30 MLD	Yes	Yes

(Source: Information from the selected ULBs)

Audit observed the following:

In ULB, Indore, provision for reuse of only 13 MLD treated effluents (water) of existing 245 MLD STP was made for gardening purpose by constructing overhead tank, connected with pipeline. The remaining treated water was being passed into the Kahn and Saraswati Rivers.

Further, in ULB, Dewas, the treated sewerage water was not being re-utilised and the same was flowing through open nalas at the output point of STPs and in Ujjain, 30 MLD water was being utilised from the Sadawal STP (old system) and new STP (92.5 MLD) is under construction, however, no provision for reuse of treated water was made in the DPR of proposed 92 MLD STP.

From **Table 2.25**, it is clear that treated water of all STPs of ULBs, Dewas, Indore and Ujjain was being reused for agriculture purpose. However, as per test reports, faecal coliform is not being tested at outflow of the STPs. Hence, the treated effluents, containing high level of faecal coliform, reused for agriculture purpose, may result in serious health problems. As the CPCB recommended (2000) parameters, faecal coliform should be of 500-2,500MPN/100ml, while the World Health Organization issued (1999) guidelines have fixed faecal coliform limit at 1,000 MPN/ 100ml to be used for irrigation of crops likely to be eaten uncooked.

The ULB, Indore stated (December 2021) that work of reuse of water have been executed as per the tender agreement and remaining treated water was passed into the river for maintaining the flow of river. However, passing of treated effluents into the rivers may also have an adverse impact on the riverine ecosystem and environment and may also defeat the objective of 100 *per cent* abatement of pollution in the river. As a result, the consent of MPPCB has also been violated.

The UDHD, GoMP stated (January 2023) in case of ULB, Dewas that treated water is being used in gardens, agricultures and washing of road and dividers. However, no details regarding utilized water and documents in support of the statement was provided.

The UDHD, GoMP was silent in case of ULB, Ujjain.

***Conclusion**: The Minor hypothesis was true. It was observed that three STPs were working on older technologies. Prescribed tests were not being conducted and water quality parameters were not within prescribed limits. Further, alternative power sources were not available in STPs as well as in pumping stations of ULBs. In Dewas, STPs were working only with 10 per cent of total capacity. Also, sufficient provision for reuse of treated effluent was not made by the ULB*

[38] Alot, Mahidpur and Sanwer.

2.6 Minor Hypothesis No-5: Sampling Methodology of Pollution Check Points and monitoring of STPs by MPPCB, as well as by ULBs, was inadequate.

Sampling and monitoring of STPs are being done by authorities of ULBs as well as by MPPCB. For this purpose, CTE and CTO are issued by MPPCB. These consents contain general and specific guidelines and modus operandi for STPs. Further, MPPCB has also issued guidelines regarding testing, compliance of which should be ensured by STP operator.

The hypothesis was checked at ULB level through various aspects, *i.e.*, applying for CTEs and CTOs, compliance to directions of CTEs and CTOs, monitoring of test results of STPs, identification of agriculture related pollution, monitoring of reports of STPs, *etc*.

Findings on above are discussed in succeeding paragraphs.

2.6.1 STPs were found to be working without CTO

One STP in Dewas and two STPs in Indore were operating without CTO from MPPCB. There were no STPs in other three ULBs.

- **Non-receipt and non-renewal of CTO of STPs**

As per the Water (Prevention and Control of Pollution) Act, 1974, it is necessary to obtain CTE from the MPPCB before starting the work of STP. Similarly, it is necessary to obtain the CTO after completion of the construction and before actual operation. The CTE is based on whether the proposed STP design meets the discharge standards for treated sewage and the CTO is based on whether all the units originally committed are actually built and are of the same size.

Further, for renewal of this consent, applicant/ operation and maintenance agency shall have to make an application to the Board through XGN at least six months before the date of expiry of consent. The applicant without valid consent of the Board shall not use any outlet of STP for the discharge of treated sewage.

In ULB, Dewas, Audit observed that trial-runs of three STPs, *i.e.*, 12 MLD, 14 MLD and 22 MLD, were started in February 2020, August 2020 and February 2021 respectively. But CTO for 12 MLD and 14 MLD were obtained in January 2021 and CTO for 22 MLD STP was not found in the records which is violation of the Water Act.

In ULB, Indore, out of total 11 STPs, two STPs did not have the CTO as per the norms prescribed by MPPCB. Validity of CTOs of two STPs of seven and eight MLD capacities was up to the period of 30 November 2021. The applications for renewal of consent of the above two STPs were not found on records.

In ULB, Ujjain, it was observed that 83 MLD STP did not have the CTO during the period 2016-18 and April 2019 to October 2021.

The UDHD, GoMP replied (January 2023) in case of ULB, Indore that CTO of five STPs had been received and CTO for other five STPs is pending at the end of MPPCB. In the case of ULB, Dewas, CTO for all three STPs had been obtained. However, documentary evidence in

support of the statement was not provided by the UDHD, GoMP and in case of ULB, Ujjain, the facts were accepted and was replied (June 2022) that efforts were made to obtain CTO during aforesaid period but could not be received from the MPPCB.

2.6.2 Non-compliance of consent conditions by the ULBs

Compliance to consent condition was not followed by seven out of 11 STPs of ULB, Indore and three STPs of ULB, Dewas. ULB, Ujjain have Wastewater Stabilization Pond system based STP and remaining three ULBs do not have STPs.

- **Non-availability of by-pass facility, non-construction of sump-well and non-availability of flow meters, dissolved oxygen meters and temperature meters at STPs**

As per Clause 3.17.10 of CPHEEO manual, proper bypass arrangements shall be provided from the inlet chamber and if required, special arrangements shall be made for pumping the sewage to the lower reach of sewer line. Further, treated sewage shall be stored in sump-well of adequate size with suitable retention period to avoid development of septic conditions. Further, it was also mentioned in the consent that water meter with digital flow recording facilities and real time online flow measuring facilities shall be installed separately for recording the sewage inflow as well as outflow of treated sewage. The industry/unit shall also monitor the treated wastewater flow and report the same online through monthly statements.

a) Audit observed that bypass system was not available in five STPs (245 MLD, 8 MLD, 7 MLD, 6 MLD and 4 MLD) at ULB, Indore. Hence, in case the treatment plant is under maintenance for any of the aforementioned reasons, water logging condition may arise at inlet that may cause adverse impacts on the sewage treatment system. The ULB, Indore stated (December 2021) that by-pass facility has been provided by using interconnections of inlet sewer pipeline of other STPs. Also, instructions have been issued to contractors for interconnection works of sewer pipeline of STPs.

However, there is no by-pass facility available in these STPs. Further, the locations of all these STPs are different. Hence, interconnections will not be possible or would be non-economical.

b) During site visits at Dewas, Audit observed that the treated sewage of STPs (12 MLD and 14 MLD) is not being stored in any sump-well and the same was flowing through open nala at the output point of STPs. Thus, due to non-allowing suitable retention period, development of septic conditions among habitants could not be ruled out.
The ULB, Dewas stated (September 2021) that there was no provision in the agreement for construction of sump well for storage of sewage treated water. So, sewage treated water flows into nalas and farmers utilize the treated water for irrigation purposes.

However, the reply indicates that conditions imposed by the MPPCB was not followed and possibility of development of septic condition was not eliminated by the ULB, Dewas.

c) Further, during site visits of Indore and Dewas, Audit also observed that the flow meters, DO meters and temperature meters were not installed at all three STPs of Dewas and two STPs (78 MLD and 12 MLD) of Indore. In the absence of flow meters, exact quantity of water treated could not be ascertained.

The UDHD, GoMP replied (January 2023) in case of ULB, Indore that instruction has already been issued to the Contractor for installation of the same and in case of ULB, Dewas, no comment was offered on

non-installation of meters.

2.6.3 Agriculture related pollution not identified

Soil test reports by RO, Ujjain and Farmer Welfare and Agriculture Development Department indicate parameters like Organic Carbon, Phosphorus and Potassium were beyond the acceptable limit.

Excessive usage of fertilisers in the agricultural land leads to leaching, especially phosphorus that runs-off from the land and causes surface water contamination by eutrophication and loss of aquatic life. The application of fertiliser also leads to groundwater contamination by leaching nitrate into the groundwater.

When water is utilised for irrigating an agricultural land (irrigation water), a part of that water returns to the groundwater or the surface water. This irrigation return flow is one of the primary causes of water pollution as it affects the quality of the water, which is again used for the purposes of agriculture and other domestic use.

Irrigation salinization of surface water and run-off of pesticides lead to surface water contamination, leaching of nutrients salts and groundwater contamination. It can also lead to decrease immunological defenses, intrauterine growth retardation and malnutrition, depletion of essential nutrients from the body.

Scrutiny of the soil testing reports sent by RO, Ujjain to MPPCB headquarters, in compliance to NGT order (September 2018) in case No. 673/2018, revealed that parameter of the Organic Carbon (OC) was more than 0.75 *per cent* in the fields of six farmers; Phosphorus was more than 25 kg/ha in the fields of seven farmers; and Potassium was more than 280 kg/ha in the fields of 17 farmers.

Further, the soil testing reports of the selected blocks of Dewas, Indore and Ujjain districts revealed that parameters of Electronic Conductivity (EC) in four (Ujjain), Organic Carbon (OC) in 518[39], Nitrogen in three (Ujjain), Phosphorus in 814 (Ujjain) and Potassium in 2,429[40] fields out of total sampled 3,027 were excess to norms. This may contaminate surface water and deplete essential nutrients and may impact human bodies as well as aquatic life in the Kshipra River.

The RO Ujjain accepted that identification of agriculture related pollution such as pesticides, fertilizers, contaminated water, *etc*., has not been done. However, the reply was silent about the future course of action on this issue for course correction in this regard.

[39] Indore 10, out of 1466 samples and Ujjain 508, out of 1533 samples.

[40] Indore 1405, out of 1466 samples and Ujjain 1024, out of 1533 samples.

2.6.4 Non-installation of Online Continuous Effluent Monitoring Systems at STPs

Total nine out of 11 STPs of ULB, Indore, one STP of ULB, Ujjain and all three STPs of ULB, Dewas had not installed Online Continuous Effluent Monitoring Systems, as per the direction of MPPCB. ULB, Ujjain had oxidation pond STP and remaining ULBs did not have STPs.

As per Section 33 A of the Water (Prevention & Control of Pollution) Act, 1974, in view of strengthening the monitoring mechanism for effective compliance through self-regulatory mechanism, MPPCB had issued following directions:

- All the STPs being operated in Million Plus Cities by the Municipal Corporations or the concerned bodies in the State shall install OCEMS for the parameters namely pH, TSS, BOD, COD before 31 January 2021.
- The STP operating authority shall connect and upload the online effluent monitoring data on the the servers of the MPPCB at Environment Surveillance Centre (ESC) at Bhopal in a time bound manner but not later than timelines as mentioned above and shall ensure regular maintenance and operation of the OCEMS with tamper proof mechanism with facilities for calibration.

During scrutiny of records and physical verification of all STPs/CETPs, it was observed (December 2021) that out of total 15 STPs/CETP of three ULBs, OCEMS was installed in only two STP/CETPs. Details are given in **Table 2.26.**

Table 2.26 Status of OCEMS at STPs of ULB

S.N.	Name of ULBs	Total Number of STPs/ CETP	STPs with OCEMS	STPs without OCEMS
1	Indore	11	2	9
2	Ujjain	1	0	1
3	Dewas	3	0	3
Total		**15**	**2**	**13**

(Source: Information from the selected ULBs)

From the above, it is clear that OCEMS, which is necessary for effective real time monitoring of STPs, is not available in 13 STPs out of 15.

The UDHD, GoMP replied (January 2023) in case of ULB, Dewas, that work order for installation of OCEMS had been issued. In case of ULB, Indore, the UDHD, GoMP stated (January 2023) that tender was invited for installation of OCEMS in one STP and two STPs of 78 and 12 MLD of Indore are in process of upgradation. The reply of UDHD, GoMP was silent in case of ULB, Ujjain.

Conclusion: *The Minor Hypothesis was observed to be true. It was observed that five STPs were operating without CTOs from MPPCB and compliance to consent conditions was not followed by STPs. Identification of agriculture related pollution was not done, though soil test reports indicated that parameters like Organic Carbon, Phosphorus and Potassium were beyond the acceptable limits. Further,OCEMS was not installed in STPs.*

2.7 Minor Hypothesis No-6: Actions are not being taken against the ULBs for releasing the untreated waste in the river.

Penalty of ₹ 6.54 crore was levied on five ULBs by MPPCB due to non-compliance of Action Plans.

The NGT's ordered (September 2018) States/UTs to prepare Action Plans to prevent discharge of sewage and effluents, dumping of waste, maintaining flood plain zones and e-flow, restoring water quality to bathing standards, etc. It was further directed to prepare Action Plans within two months for bringing all the polluted river stretches to be fit at least for bathing purposes (*i.e.*, BOD < 3 mg/L and FC < 500 MPN/100 ml). This should be done within six months from the date of finalisation of the action plans. The Tribunal further extended its execution for two years (up to June 2021). In case, ULBs failed to prepare action plan for polluted river stretches and to make polluted river stretches at least fit for bathing purpose within aforesaid timeline, MPPCB shall act against such ULBs.

The hypothesis was checked at ULB level through various aspects, *i.e.*, compliance to Action Plans, submission of returns, arrangements of sewage treatment by ULBs and monitoring by MPPCB.

Findings on above are discussed in succeeding paragraphs.

2.7.1 Action had not been taken against ULBs for failure in setting up of STPs and default in in-situ remediation

According to Hon'ble NGT orders, 100 *per cent* treatment of sewage may be ensured by the end of March 2020 at least to the extent of in-situ remediation and before the said date, commencement of setting up of STPs, the work of connecting all the drains and other sources of generation of sewage to the STPs must be ensured. In case of failure, the local bodies and the departments concerned of the States/UTs will be liable to pay compensation at the rate of ₹ five lakhs per month per drain, for default in in-situ remediation and ₹ 10 lakhs per STP for default in commencement of setting up of the STP.

Scrutiny of the records revealed that as of March 2022, MPPCB had levied penalty of ₹ 6.54 crore up to December 2021 on five ULBs due to failure in completion of the sewerage network and tapping of drains, as shown in **Table 2.27**.

Table 2.27: Status of penalty imposed up to December 2021

S.N.	Name of ULB	STP /FSTP status	MPPCB levied penalty (₹ in lakh)
1	Ujjain	Under construction	Not levied
2	Dewas	Under Construction	72.00
3	Indore	One STP under construction	240.00
4	Alot	Under construction	90.00
5	Mahidpur	Under construction	90.00
6	Sanwer	Under construction	162.00
Total			**654.00**

(Source: Information from the selected ULBs)

The ROs of MPPCB replied that the Board had levied environment compensation on ULBs for non-execution of works related to bioremediation and solid waste management.

Replies of the ROs are not acceptable as compensation as per instructions of NGT had not been recovered from these ULBs and no further efforts were made for recovering the same.

2.7.1.1 Discrepancies noticed by MPPCB

During the inspection, MPPCB noticed (December 2021 and January 2022) that at various points, the wastewater was merging in Kshipra and Kahn Rivers. The report of the deficiency noticed by MPPCB was also sent to the Commissioners of ULBs, Indore and Ujjain. Following were the observations of MPPCB:

ULB, Ujjain

- The treated wastewater from 83 MLD STP at sadawal was merging in Kshipra River through Bhandariakhal Nala, instead of Kahn River diversion pipeline and the overflow from Manchaman and Gaughat Pumping stations was also merging in Kshipra River.
- The untreated mixed dye wastewater from Bhairavgarh area, through Bhairvagarh nala, untreated wastewater from the collection pit at *Durga das ki Chhatri*, from Indiranagar through Pilyakhal Nala, PHE colony and near Indore Road Bridge, at Triveni were merging in Kshipra River and the wastewater discharge was also observed from Meghdoot Hotel in the catchment area of Kahn River.

  It was instructed by MPPCB to ULB, Ujjain that for the treatment of wastewater, the sewerage network is required to be strengthened, so that the Kshipra River can become pollution free.

ULB, Indore

- The untreated wastewater from Shiv Dham colony, near the origin of Kahn River, Banwari Nagar near Radha Swamy STP, near Azad Nagar STP, Manoramganj near Palasiya Nala, Pusplok and Chandralok colony, Ekta Nagar, Puspa Nagar, Ram Nagar, Rakhi Nagar, *etc*. was merging in Kahn River.
- One CETP of only 4 MLD was constructed by ULB, Indore, however, remaining wastewater approx. 5-6 MLD, was merging in Kahn River through Narwar nala near Dhankhedi.

It was instructed by MPPCB to ULB, Indore to strengthen the sewerage network and effective operation of STPs and CETP.

It is pertinent to mention here that in spite of having the above deficiency in the sewerage network/treatment and merging of wastewater in Kshipra River, MPPCB, Ujjain had not levied any penalty on ULB, Ujjain in compliance with the directions of NGT.

2.7.2 Non-submission of monthly progress report

Monthly progress reports/ status report containing compliance to Action Plans were not being sent to the MPPCB.

The NGT directed (September 2018) to prepare Action Plans to prevent discharge of sewage and effluents, dumping of waste, maintaining FPZs and e-flow, restoring water quality to bathing standards and accordingly monthly progress report may be furnished by the States/UTs to Secretary, Ministry of Jal Shakti with a copy to CPCB through SPCB. Any default must be

viewed with serious consequences at every level, including initiation of prosecution, disciplinary action and entries in ACRs of the erring officers.

It was, however, noticed in ULB, Ujjain that no such monthly reports/status report containing compliance to Action Plan was being sent to the MPPCB for onwards submission to Ministry of Jal Shakti, GoI.

The UDHD, GoMP had not offered any comment on this.

Conclusion: *The Minor Hypothesis was mostly true. It was observed that due to non-compliance to the Action Plan, penalty was levied on ULBs by MPPCB but not recovered. Also, monthly progress reports containing compliance to Action Plan were not being sent to the MPPCB.*

2.8 Recommendations

Audit recommends that:

- The ULBs may prepare City Sanitation Plan; appropriate Sewerage Network may be developed by the ULBs and house connections may be provided to every household.
- The ULBs may prepare Faecal Sludge and Septage Management Policy and may develop proper system of collection, transportation and disposal of Faecal Sludge and Septage.
- The ULBs may ensure to utilize the full capacity of STPs and sufficient provision for reuse of treated effluent may be made and the compliance of the Action Plan may be ensured.
- Action may be taken against erring officials for acts of omission resulting in excess payment and non-monitoring of projects.

CHAPTER 3

TREATMENT OF INDUSTRIAL WASTE

3 CHAPTER

Treatment of Industrial Waste

Sub-Major Hypothesis No-2: Treatment of Industrial Waste is Inadequate.

3.1 Introduction

The Central Pollution Control Board has categorised water bodies into five categories on the basis of their pollution/contamination levels based on following parameters, as shown in **Table 3.1**.

Table 3.1: Category of water bodies on the basis of their pollution/contamination levels

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organisms MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen (DO) 6mg/l or more Biochemical Oxygen Demand 2 mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organisms MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5 mg/l or more Biochemical Oxygen Demand 3 mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organisms MPN/100 ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4 mg/l or more Biochemical Oxygen Demand (5 days 20^0C) 3 mg/l or less
Propagation of Wildlife and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4 mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25^0C (micro mhos/cm) maximum 2,250 Sodium Absorption Ratio maximum 26 Boron maximum 2 mg/l

(Source: Central Pollution Control Board)

The NGT directed[1] (September 2018) all States and Union Territories to prepare Action Plans within two months for bringing all the Polluted River Stretches to be fit at least for bathing purposes (*i.e.*, Biochemical Oxygen Demand (BOD) < 3 mg/l and Faecal Coliform (FC) < 500 MPN/100 ml) within six months from the date of finalisation of the Action Plans, which was later extended up to March 2021.

Kshipra River from Triveni to Siddhawat in Ujjain and the whole stretch of Kahn River were declared as Polluted River Stretches by CPCB as well as MPPCB on account of the quality of

[1] NGT Case No. 673/2018.

water being D/E category.

The MPPCB is the sole agency to maintain water, air and soil in healthy and usable condition for various purposes in the state. In this regard, the MPPCB monitors water quality of Kshipra and Kahn Rivers from 13 monitoring stations. However, at only one out of 13 monitoring stations, the water quality was of "A" category and that too only in one year (2020-21). The other 12 stations have been recording water quality mostly of "C/D/E" category over the period of five years, which is not suitable even for bathing purposes. Details are shown in **Table 3.2.**

Table 3.2: Water quality parameters at Kahn and Kshipra Rivers for the period 2016-17 to 2020-21

S.N.	Sampling Stations	Average of Category of water quality of points during the year				
		2016-17	2017-18	2018-19	2019-20	2020-21
1	River Kahn at Kabitkhedi, Indore	D	E	E	E	E
2	River Kahn at Shakkarkhedi, Indore	D	E	E	E	E
3	River Kahn at Sanwer, Indore	D	E	E	E	D
4	River Kahn at Ramwasa, Indore	C	C	D	C	D
5	River Kshipra at Intake/Water supply Dewas	B	B	B	B	A
6	River Kshipra at Hawankhedi, Dewas	C	C	B	C	E
7	River Kshipra at Marethi, Dewas	C	D	B	D	C
8	River Kshipra at Gaughat, Ujjain	D	D	D	D	D
9	River Kshipra at Siddhawat, Ujjain	D	D	D	D	D
10	River Kshipra at Ramghat, Ujjain	D	D	D	D	D
11	River Kshipra at 01 km Downstream, Ujjain	D	D	D	D	D
12	River Kshipra at Mangalnath, Ujjain	D	D	D	D	D
13	River Kshipra at Mahidpur	C	C	C	D	B

(Source: Water Quality Index published by the Madhya Pradesh Pollution Control Board)

Further, there were total of 6,777[2] industries in the catchment of Kshipra River and its tributary Kahn in Dewas, Indore and Ujjain districts. Out of these, 2,844[3] industries were water consuming industries. One of the main causes of water pollution is disposal of untreated, partly treated industrial waste/ effluents in the rivers. Industrial effluents are the source of some of the most toxic pollutants. They contribute significantly to the overall water pollution (both the surface and ground water) in an area and are considered to be more hazardous than sewage. Further, as per the Water (Prevention and Control of Pollution) Act, 1974, the main objective of the State Pollution Control Board (SPCB) is to continuously monitor and maintain the water quality of the state. The registration of Industries by MPPCB is done through XGN software.

[2] 778 industries in Dewas, 5,101 in Indore and 898 in Ujjain districts.
[3] 628 water consuming industries in Dewas, 1,717 in Indore and 499 in Ujjain.

XGN SOFTWARE

XGN (eXtended Green Node) is an application for the Organizations/Industries to apply online for the Consent to Establish (CTE)/Consent to Operate (CTO) under Air (Prevention and Control of Pollution) Act, 1981 and Water (Prevention and Control of Pollution) Act, 1974 or both. Before establishment of industrial project, the applicant is required to obtain CTE. The CTO is required to be obtained at the time of starting operation/production at the industrial plant.

As per the consent granting procedure of MPPCB, the applicant is required to submit the application with all the technical details and required documents. After verification/acceptance of the same, Regional Officer (RO), if satisfied, sends request to the applicant for submission of the fee through XGN. When the fee is deposited by the applicant, RO conducts inspection and in case of large and medium scale industries, forwards the application to Head Office of MPPCB at Bhopal along with the Inspection Report. Based on the technical evaluation of the application, the file is processed online by the MPPCB Head Office. Further, RO is authorized to decide the application for grant of consent for small scale industries. It is pertinent to mention here that all the above procedure is required to be completed within 45 days, from the date of submission of application.

It is pertinent to mention here that MPPCB in its reply stated (December 2022) that there is a bug in XGN software due to which some information are not depicted correctly.

The reply reflects total lack of interest and apathy of Pollution Control Board. If there is a bug in such an essential software and the board carried out its planning and activities on the basis of XGN data then it clearly indicates that board had not at all been monitoring the data furnished by industries to XGN or corroborating such information through adequate inspection. Government may fix responsibility for erring officials for this lapse in the system.

3.2 Minor Hypothesis No-7: Industries are working without obtaining consent to establish and consent to operate from MPPCB

As per Section 25 of the Water (Prevention and Control of Pollution) Act, 1974, no person shall, without the previous consent of the SPCB, (a) establish or take any steps to establish any industry, operation or process, or any treatment and disposal system or any extension or addition thereto, which is likely to discharge sewage or trade effluents into a stream or well or sewer or on land; or (b) bring into use any new or altered outlet for the discharge of sewage; or (c) begin to make any new discharge of sewage.

The MPPCB has classified (October 2021) industries in the Red, Orange, Green and White category on the basis of Environmental Pollution Index (EPI), as detailed in **Table 3.3** below.

Table 3.3: Category of Industries

S.N.	Category of Industries	Types of Industries
1	Red	Includes highly polluted industries of 17 types, viz. Bulk/basic drugs and related R&D activities, Distilleries, Tanneries, Fertilizers, Oil refineries, *etc.*
2	Orange	Cotton spinning, Flour mills, Hotels and Restaurants, Malted food and fragrance, *etc.*
3	Green	Ice cream and ice making, handloom weaving, Rice mills, *Daal* mills, *etc.*
4	White	Assembly of air coolers/conditioners and repairing, bio fertilizers/ bio-pesticides, biscuits trays and blending and packing of tea, *etc*.

(Source: MPPCB)

The hypothesis was checked in three Regional Offices[4] (ROs) of MPPCB through various aspects, *i.e.*, Industries' applications, renewals and delays related to CTE and CTO.

Our findings *vis-à-vis* the above hypothesis are discussed in detail below:

3.2.1 Discrepancies in Industrial Consent

As per the Water (Prevention and Control of Pollution) Act, 1974, MPPCB is authorised to issue consent to industries for establishment and operation. The following discrepancies were noticed regarding consent to industries in three selected ROs of MPPCB.

3.2.1.1 Delays in approval of consent by MPPCB

Consent to 233 applicants in Ujjain, 97 in Dewas and 389 in Indore were granted belatedly with a period ranging from 46 to 615 days, which should have been given in fixed time schedule of 45 days.

Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 provides that prior consent of the Board was essential to establish any industry, operation or process and as per the order issued by the Member Secretary, MPPCB (October 2014 and August 2015), 45 days time limit was fixed individually for issue, original as well as revised consent. A robust system of clearing or rejecting consent applications within specified time is necessary, else it can lead to cases where industries operate without consent, while waiting for the application to be cleared.

Audit observed that during the period 2016-21, 233 applicants in Ujjain, 97 applicants in Dewas and 389 applicants in Indore were granted consent belatedly. The period ranged from 46 to 615 days in Ujjain, 49 to 270 days in Dewas and 46 to 285 days in Indore, which should have been given in the fixed time schedule of 45 days.

MPPCB replied (December 2022) that the consent cases are required to be decided within 45 days on completion of application in all respect and the order (2015) of the Board is an internal order to maintain the discipline and fast disposal of application for consent/renewal and the

[4] RO; Dewas, Indore and Ujjain.

time limit of 120 days as per Air/Water Acts, should be used for Audit purpose.

The Reply of MPPCB is factually not correct because as per the consent granting procedure of MPPCB, the applicant is required to submit the application with all the technical details and required documents and only after verification/ acceptance of the same, Regional Officer (RO), if satisfied, processes the same, or can reject the application as well if the required information is not submitted. All these procedures are required to be completed within 45 days from the date of submission of application. Further, the order of 2015 was duly notified and uploaded in public domain, hence, stating that the same is an internal order is misleading.

3.2.1.2 Industries working without Consent to Operate

Out of 6,777 Industries of red and orange categories in Dewas, Indore and Ujjain, 505 were irregularly operating without obtaining CTO.

For the purpose of establishing an industrial project, the applicant is required to obtain CTE. Once the industry or process plant is established along with the required pollution control systems, the applicant is required to obtain CTO for operating the unit. This consent is given for a particular period, which needs to be renewed regularly.

As per Section 25 of the Water (Prevention and Control of Pollution) Act, 1974, consent of the Board was required to establish or take any step to establish any industry, operation or process which was likely to discharge sewage. Previous consent of the State Board is also required under Section 25 (1) (a) of the Water Act, 1974 in case of an extension or addition by such industries.

Further, as per Section 44 of the Water Act, whoever contravenes the provisions of section 25 or section 26 shall be punishable with imprisonment for a term which shall not be less than one year and six months, but which may extend to six years with fine.

The Act empowers the Board to issue CTE/CTO and their periodical renewal. Consent to large/medium scale industries was granted by the Board at Head Office level and for Small Scale Industries (SSIs), consent was granted by the respective ROs. Status of CTOs obtained by the industries is shown in **Table 3.4.**

Table 3.4: Showing the details of Industries working without consent to operate

S. N.	Name of RO Offices	Total No. of industries	Nos. of industries operational without CTO	No. of industries which had never applied for CTO
1	Dewas	778	147	85
2	Indore	5,101	242	251
3	Ujjain	898	116	237
Total		**6,777**	**505**	**573**

(Source: XGN data of Madhya Pradesh Pollution Control Board)

Audit observed in selected ROs of MPPCB that there are total of 6,777 industries in Dewas, Indore and Ujjain, out of which 505 industries of red and orange categories were operational without consent as validity of their CTO had expired. Industries without consent will be more susceptible to creating water pollution. Further, 573 industries had never even applied for CTO (**Table 3.4).** It was, however, noticed that according to section 44 of the Water Act, 1974, no

such action against those industries was taken by the ROs.

MPPCB replied (December 2022) that as per the provisions of Water/Air Acts, it is the responsibility of Industries to obtain CTO and get it renewed from the Board and the grant of renewal is a regular process. Further, the process of granting renewal of consent for a minimum of five years had begun from 1st April 2022 and notices were issued to the industries for the renewal of consent after audit raised the issue.

The reply indicates the lackadaisical attitude of the RO as no action had been taken to cancel the CTE licenses of the industries which did not obtain the consent after lapse of the stipulated time period. Further, there were several instances where industries were operating without CTOs *viz.*, CTOs of M/s Ruchi Fabrics and Vishwakarma Trading Company had expired on 31 December 2019 and 31 July 2020 respectively. Inspections for renewal of CTOs of these industries were done by the PCB on 21 December 2020 and 8 April 2021 respectively. In between, both of these industries were showing as operational (as seen on XGN[5] portal). Similarly, MS Super, Adnoc Chemicals, Harshita Enterprises and Quality Steels that had CTE, were operating without obtaining CTO after commissioning.

Further, after raising the issue by Audit, RO, Indore have issued notices to 119 industries for obtaining/renewal of the consent. This also shows that the industries were operating without a valid CTO. Hence, responsibility for the lacuna in monitoring on the part of ROs concerned should have been fixed by MPPCB.

***Conclusion**: The Minor Hypothesis was tested and found to be true. In all three ROs of MPPCB, the consent was granted belatedly ranging from 46 to 615 days. Further, there were industries which were operational without consent as the validity of their CTO had expired and no action had been taken by the Board against such industries.*

3.3 Minor Hypothesis No-8: There was improper monitoring and inspection of Industries by the MPPCB.

As per the direction[6] of NGT, CPCB instructed (December 2019) all the SPCBs to ensure that for environmental surveillance, industries are inspected frequently. Further, as per consent conditions, compilation of monitoring data and reporting of the same online through XGN to the Board and maintaining online records of all information resulting from monitoring activities is required.

The hypothesis was checked at selected ROs[7] of MPPCB through various aspects, *i.e.*, mechanism for inspection and monitoring mechanism for compliance of consent conditions. In the selected ROs of MPPCB, 131[8] red category (including highly polluting) wastewater generating industries were sampled for test checking the hypothesis.

Findings on above hypothesis are discussed in detail as below:

5 Reference paragraph 3.1.
6 Case No. 693/2018.
7 RO, Dewas, Indore and Ujjain.
8 Dewas (34), Indore (56) and Ujjain (44).

3.3.1 Deficiency in carrying out the inspections by the MPPCB

During the year 2020-21, only 34 *per cent* inspections were carried out by the selected ROs. Though an order for inspections on the basis of lottery system were available before this, but no such inspections were conducted.

As per the direction (December 2019) of the CPCB, industries should be inspected preferably at the frequency as mentioned in **Table 3.5**.

Table 3.5: Frequency of inspections

S.N.	Industrial Category	Frequency of mandatory inspection for Environmental Surveillance
1	Highly Polluting (17 categories[9])	3 months
2	Red Category (other than 17 categories)	6 months
3	Orange Category Industries	1 year
4	Green Category Industries	2 years
5	CETP/STP	3 months

(Source: Central Pollution Control Board)

It was observed that against the required 300 inspections in the selected 131 industries, only 103 (34 *per cent*) inspections were carried out by the MPPCB during the year 2020-21. Thus, there was a shortfall of 197 inspections, as detailed in **Table 3.6**. Also, surprise inspections were not being carried out by the ROs.

Table 3.6: Shortage in inspections of the industries during 2020-21

S.N.	Name of Regional Office	No. of sampled industries	Total No. of inspections required	Inspections carried out	Shortfall in inspections
1	Dewas	31	72	31	41
2	Indore	56	130	52	78
3	Ujjain	44	98	20	78
4	**Total**	**131**	**300**	**103**	**197**

(Source: XGN data of Madhya Pradesh Pollution Control Board)

Further, before implementation of CPCB order (December 2019), the MPPCB orders (April 2015) regarding inspections on lottery basis were in force, but no such inspections were also being carried out by the selected ROs.

MPPCB replied (December 2022) that as per the policy of ease of doing business, routine inspections were adjourned and due to insufficient staff, it is not possible to achieve the frequency of inspections as directed by CPCB.

Reply of MPPCB is not acceptable as there was a massive (66 *per cent*) shortfall in inspections during the year 2020-21. Further, no such inspections were being carried out by the ROs earlier also though the Order (April 2015) regarding inspections on lottery basis was in existence. Regarding shortage of staff, the action should have been taken by MPPCB to address the issue.

[9] Chlor – Alkali, Aluminium, Cement, Copper, Dyes & Intermediates, Distillery, Fertilizers, Iron and Steel, Oil Refineries, Pulp & Paper, Petrochemicals, Pesticides, Pharmaceuticals, Sugar, Tannery, Thermal Power, Zinc.

3.3.2 Irregular submission of monthly reports by Industries

Out of 131 sampled red category industries in the three selected ROs, 58 industries were not submitting online discharge monitoring report/ monthly testing report to MPPCB.

As per consent condition, compilation of monitoring data includes samples and measurements taken to meet the monitoring requirements, promulgation of guidelines, establishing test procedures for the analysis of pollutants, *etc*. Accordingly, the applicant shall take samples and measurements to meet the monthly requirements specified above and report these online through XGN to the Board and maintain online records of all information resulting from monitoring activities. The applicant shall record each measurement of samples taken pursuant to the requirements of the Consent.

Monitoring Information required by the consent shall be summarized and reported by submitting a Discharge Monitoring Report online to the Board.

Audit noticed that out of 131 selected red category Industries, 58 Industries[10] were not submitting online discharge monitoring report/monthly testing report through XGN to MPPCB.

MPPCB replied (December 2022) that all the 17 highly polluted industries were having online monitoring systems. Thus, real time monitoring data is available on the server of the Board. Further, some of the industries are submitting offline monitoring data and the Board has informed the units to comply with the consent conditions and upload the monitoring reports from time to time.

The reply is not acceptable as monitoring reports regarding discharge and test results of these selected industries were not found on XGN. Also, due to the absence of discharge monitoring reports and test results, effective monitoring of the industries was not possible. Further, when everything related to the industry is available on XGN, there is no sense in using offline reports submission system for the monitoring purpose.

Conclusion: *The Minor Hypothesis was tested and was observed to be true, as only 34 per cent inspections were carried out by MPPCB and 44 per cent of the selected industries were not submitting online discharge monitoring report/monthly testing report to MPPCB.*

3.4 Minor Hypothesis No-9: Zero Liquid Discharge policy and Consent condition were not working as per the laid norms.

Zero Liquid Discharge (ZLD) means zero discharge of wastewater from Industries. ZLD system involves innovative and a range of advanced wastewater treatment technologies to recycle, recovery and re-use of the 'treated' wastewater and thereby ensure there is no discharge of wastewater in the environment.

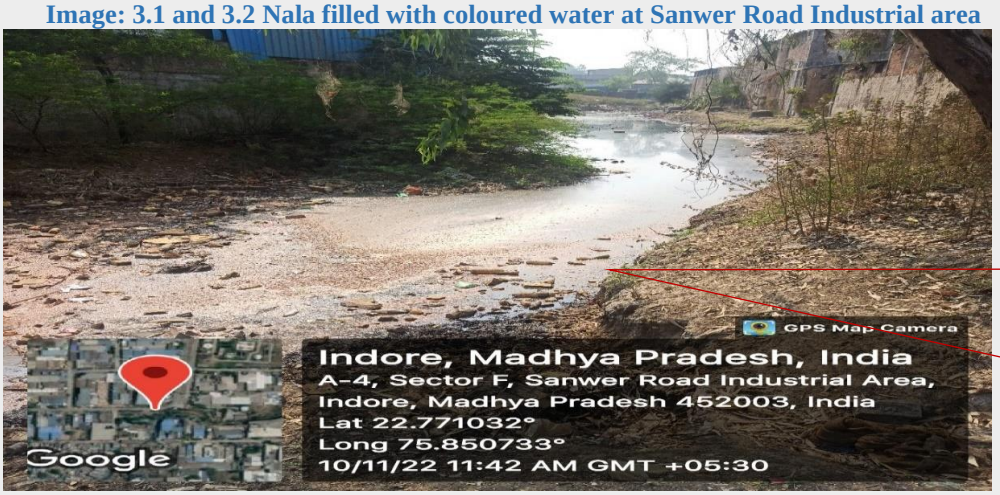
The hypothesis was checked in ROs of MPPCB, through various aspects, *i.e.*, installation of

[10] 11 Industries of Dewas, 25 industries of Indore and 22 Industries of Ujjain.

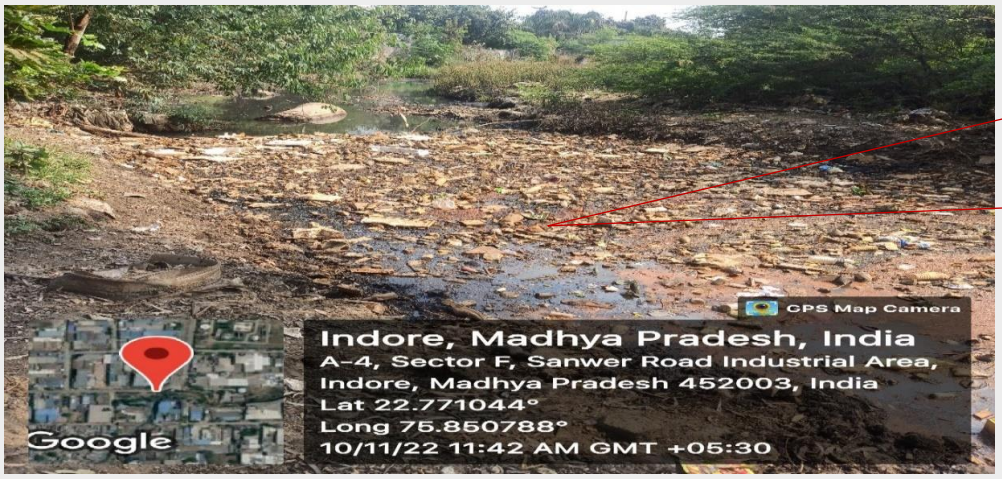
ETPs and Diesel Generator sets, availability of CETPs, compliance of ZLD mechanism and installation of water meters in the ETPs.

Further, during physical verification carried out at Industrial area of Indore, it was observed that nalas of industrial area were filled with colored water as shown in below images:

Image: 3.1 and 3.2 Nala filled with coloured water at Sanwer Road Industrial area



Showing coloured water discharge from the Sanwer road Industrial area, Indore.



Showing coloured water discharge from the Sanwer road Industrial area, Indore.

From the above images, it is clear that industries are discharging industrial waste in nearby drains which were ultimately merging in Kahn River/Kshipra River. Accordingly, findings on above hypothesis are discussed in detail as below:

3.4.1 Non-Installation of Effluent Treatment Plants and Diesel Generator sets by the Industries

Out of 2,844 water consuming industries in Dewas, Indore and Ujjain, 397 industries are not having ETPs and 1,116 Industries, which had ETPs, were not equipped with alternative source of power for continuous operations.

It was ordered[11] by the Apex Court (February 2017) that the industry requiring CTO, can be permitted to run only if its primary effluent treatment plant is fully functional. As per the consent given to the industries, the effluents shall be treated up to a prescribed standard and

[11] In Paryavaran Suraksha Samiti and Another vs Union of India (WP No. 375 of 2012).

reused in the process for cooling and for green belt gardening within premises and in no case, treated effluent shall be discharged outside of industries/units premises. However, it was noticed that there were 2,844 water consuming industries in Dewas, Indore and Ujjain, out of which 397 industries were not having effluent treatment plants (ETPs). Further, 1,116 industries, which were having ETP, were not equipped with the alternate source of power, *i.e.*, Diesel Generator (DG) Sets, as detailed in **Table 3.7.** In the absence of DG sets, if there is a power failure, working of ETPs may get affected, hampering the treatment process.

Table 3.7: Details of non-installation of ETPs and DG sets

S.N.	Name of Regional Office	No. of water consuming industries	Industries having ETP but not having DG set	Industries not having ETP
1	Dewas	628	271	98
2	Indore	1,717	468	224
3	Ujjain	499	377	75
Total		**2,844**	**1,116**	**397**

(Source: XGN data of Madhya Pradesh Pollution Control Board)

MPPCB replied (December 2022) that most of the water polluting industries in Indore were connected with the CETP. Some of the industries were not required to install the ETP as they are not generating industrial waste. Further, the electricity was supplied to the industries 24x7 by concerned authority, hence, short duration of power cut will not affect ETPs.

The reply is factually incorrect as all industries were supposed to install ETPs mandatorily, if the treated waste from ETP is still of poor quality, it could be connected to CETP, in terms of the order of the Apex Court. Also, there are no records to indicate that the essential condition of having an alternative power source has been waived off by the Government.

3.4.2 Non-availability of Common Effluent Treatment Plants

CETPs were not available at Dewas and Ujjain, in spite of CPCB's assessment and Apex Court's order.

The NGT instructed (September 2018) to prepare an Action Plan for rejuvenation of Kshipra River by identification of polluting sources including functioning/status of STPs/ETPs/CETPs. Accordingly, the MPPCB had planned (October 2018) to set-up a CETP in Ujjain within two years and 1.2 MLD CETP was required to be set-up in Dewas as assessed by the CPCB as well. But no such CETPs were constructed in Ujjain and Dewas.

Further, the Apex Court had also directed[12] (February 2017) to prioritize setting-up of CETPs up to 2017-18 in such cities/town/villages, where discharge of industrial pollutants and sewage was directly merging into rivers and water bodies.

Out of three[13] test checked ROs, CETPs were not available in the Dewas and Ujjain industrial areas though there were 499 water consuming industries in Ujjain and 628 such industries in Dewas. The non-availability of CETPs may lead to disposal of industrial effluents in a manner that may be harmful for water bodies, *i.e.*, Kshipra River and underground water.

[12] In the case, Paryavaran Suraksha Samiti and another Vs Union of India (WP No. 375 of 2012).
[13] Dewas, Indore and Ujjain.

MPPCB replied (December 2022) that the concept of CETP is applicable to such clusters of water polluting industries where industries had not installed ETP for treatment of wastewater. No such clusters of industries exist in Ujjain and Dewas region.

The reply of MPPCB is factually not correct as after intervention by the Apex Court, the NGT and CPCB emphasized the need of CETPs in the industrial areas. Further, construction of CETP was included in the Action Plan of the Kshipra River but not implemented by the MPPCB/State Government.

3.4.3 Improper monitoring mechanism to ensure ZLD status

Out of 131 sampled red category industries in the three selected ROs, 11 Industries were to ensure proper mechanism for ZLD status. However, only 04 industries ensured ZLD norms.

According to Para 4.8.4 of Madhya Pradesh State Environmental Plan, 2021 and as per the orders of the NGT from time to time, the concept of ZLD came into being in 2014. CPCB issued the 'Indicative Guidelines on Techno-economic Feasibility of Implementation of ZLD for Water Polluting Industries' in December 2014 wherein ZLD had been defined as installation of facilities and system which will enable industrial effluent for absolute recycling of or re-use and converting solute (dissolved organic and in-organic compounds/salts) into residue in solid form by adopting method of 'concentration and evaporation'.

On scrutiny of records of Dewas, Indore and Ujjain Regional Offices, Audit observed that out of 131 sampled red category industries, 11 industries were required to follow proper mechanisms to ensure compliance of ZLD norms by getting equipped with Reverse Osmosis (RO) and Multi Effect Evaporator (MEE) system. Out of these, only four industries were following ZLD norms and remaining seven were being operating without equipped with RO and MEE to comply with ZLD norms, as detailed in **Table 3.8**. In absence of ZLD norms, treatment of industrial effluents to such extent as required, was not possible and same will enhance pollution in the waterbodies/Kshipra River.

Table 3.8: Details of industries not complying with ZLD norms

S. N.	Name of Regional Office	No. of selected red category industries	As per CTO condition, industries required to follow ZLD	Industries complying with ZLD norms	Industries not complying with ZLD norms
1	Dewas	31	07	03	04
2	Indore	56	04	01	03
3	Ujjain	44	0	0	0
Total		**131**	**11**	**04**	**07**

(Source: XGN data of Madhya Pradesh Pollution Control Board)

MPPCB replied (December 2022) that the ZLD components are applicable only to the 17 Highly Polluting industries. All the industries have installed the required ETP and the condition of ZLD is being fulfilled.

The replies are not in sync with the ground realities, as the data submitted by the industries was easily available/accessible to the ROs (through XGN), which clearly shows that the

industries were not complying with the ZLD norms (as shown in **Table 3.8**). The reply indicates an absolute lack of monitoring of industries by the ROs.

3.4.4 Non-installation of water meters

Out of 131 sampled red category industries in the three selected ROs, only seven Industries were equipped with water meters.

As per general condition of Consent, 'water meter, preferably electromagnetic/ultrasonic type with digital flow recording facilities shall properly be maintained for category wise consumption of water for industrial cooling/boiler feed, industrial process and domestic purposes and the data shall be submitted online through XGN monthly. The industry/unit shall also monitor the treated wastewater flow and report the same online monthly.

Audit observed in selected ROs that only seven (5.34 *per cent*) industries out of sampled 131 red category industries were equipped with water meters and in the 124 remaining industries, water meters were either not installed or not working properly, as detailed in **Table 3.9**.

Table 3.9: Details of installation of water meters

S.N.	Name of Regional Office	No. of selected industries of red category	No. of industries	
			Not equipped with water meters or meters not working	Equipped with water meters
1	Dewas	31	25	6
2	Indore	56	56	0
3	Ujjain	44	43	1
Total		**131**	**124**	**7**

(Source: XGN data of Madhya Pradesh Pollution Control Board)

MPPCB replied (December 2022) that Industries had been instructed to install the water meters and update their records in XGN portal.

The fact remains that despite inspections of the industries by the respective ROs, the industries continue to operate without water meters. Further, Water meters are a mandatory requirement as per CTOs issued to the industries and it is a monitoring mechanism to watch intake and wastewater generation in the industries for measuring pollution and non-installation of the same is lax on the part of ROs. Further, after raising the issue by Audit, RO, Indore have issued instructions to industries for installation of water meters and updating the same on XGN.

***Conclusion**: The Minor Hypothesis was tested and was found to be true. Industries are either running without ETPs or were not equipped with alternative source of power. CETPs are not available in Dewas and Ujjain. A proper mechanism for ensuring compliance with ZLD status was not available. Further, only five per cent of the selected Industries were equipped with water meters.*

3.5 Minor Hypothesis No-10: The sampling process and testing of river water were deficient.

Water Quality Monitoring Guidelines (WQMG), 2017 and Gazette Notification (March 1988) envisages the criteria for deciding the sampling points, frequency and parameters to be checked

for groundwater /Surface Water and their preservation/transportation. As per WQMG 2017, type of station and frequency of sampling are detailed in **Table 3.10**.

Table 3.10: Showing type of station and frequency of sampling

S.N.	Type of Station	Definition of particular type	Frequency
1	Base line Station	Station where there is no influence of human activities on water quality.	Six times/Year
2	Trend Station	The monitoring location is designed to show how a particular point on a watercourse varies over time due to both geogenic and anthropogenic activities.	Twelve times/ Year
3	Flux Station (or Impact Station)	The location for measuring the mass of particular pollutant on main river stem for measuring the extent of pollution due to human interference or geological feature at any point of time and is necessary for measuring the impact of pollution control measures adopted.	Twenty Four times/Year
4	Hotspot Station	Location/site where concentration of a particular parameter or a group of parameters, except bacteriological parameters, are beyond the permissible limits of drinking water quality as prescribed in the BIS code IS 10500:2012.	Twenty Four times/Year

(Source: Water Act, 1974)

Out of the three ROs in Ujjain, Dewas and Indore, two ROs[14] had been equipped with laboratories for monitoring and analysis of air, water, soil, and solid wastes. They also had qualified and trained manpower for environmental monitoring, analysis and interpretation of monitoring data. Sub-Regional Offices and monitoring centres had also been provided with a few instruments essential for sample collection and analysis of those parameters which were required to be done as per set standard norms.

The hypothesis was checked at selected ROs of MPPCB, through various aspects, *i.e.*, sampling points and sampling frequency as per guidelines, parameters for sampling points, submission of results to higher authorities, regular testing of industrial waste parameters in Kshipra River, testing at industries/STPs and submission of test reports.

Findings on the above hypothesis are discussed in detail in the ensuing paragraphs.

3.5.1 Sampling points not categorised by RO Dewas

RO Dewas failed to categorise the monitoring stations into baseline, trend, flux and hotspot stations on the basis of water quality.

As per WQMG, 2017, the monitoring stations shall include a mix of baseline, trend, flux and hotspot stations, and frequency and parameters to be tested are detailed in the guidelines.

Audit observed in RO, Dewas that sampling points were not decided on the basis of WQMG and were also not categorised as baseline, trend, flux and hotspots stations.

MPPCB replied (December 2022) that the frequency and parameters for analysis of samples are as per the protocol of the guidelines. However, the WQMG, 2017, was not followed by RO

[14] Indore and Ujjain.

Dewas, as the sampling points were not categorized as per the guidelines.

3.5.2 Testing of water quality with lesser number of parameters

Out of 35 parameters required to be tested, the parameters tested ranged from 21 to 33 only, in ROs Dewas, Indore and Ujjain.

As per the Gazette Notification (March 1988), the MPPCB was to monitor the water quality of natural water sources, river, pond, nala, *etc*., on the basis of 35 parameters, which *inter alia* include colour, smell, taste, pH, BOD, FC, TC, heavy metals, pesticides, radioactive material, *etc*.

Scrutiny of test reports of the 11 monitoring stations located at various places in Kshipra and Kahn Rivers under scheduled monitoring programmes for the period 2016-21 revealed that against 35 parameters to be tested, RO, Dewas tested an average of 21-33 parameters (three locations) while RO, Ujjain tested an average of 27-28 parameters (five locations) and RO, Indore tested an average of 31-32 parameters (three locations). The details are given in **Table 3.11**.

Table 3.11: Details of testing carried out by the ROs, Dewas, Ujjain and Indore

S.N.	Location of monitoring station	Type of monitoring station	Number of parameters tested
Kahn River			
1	Kabitkhedi, Indore	Trend	31-32
2	Shakkarkhedi, Indore	Trend	31-32
3	Sanwer, Indore	Trend	31-32
Kshipra River			
4	Intake/Water supply Dewas	Not Categorised	27-33
5	Hawankhedi, Dewas	Not Categorised	23-31
6	Marethi, Dewas	Not Categorised	21-26
7	Gaughat, Ujjain	Trend	27-28
8	Siddhawat, Ujjain	Trend	27-28
9	Ramghat, Ujjain	Trend	27-28
10	One km Downstream of *Triveni Sangam*, Ujjain	Trend	27-28
11	Mahidpur, Ujjain	Trend	27-28

(Source: RO, MPPCB)

Audit observed that in Dewas, Faecal Coliform[15] and Total Coliform[16] were not being regularly tested at Hawankhedi and Marethi. Further, in Kshipra and Kahn Rivers, important parameters, such as toxic metals (Pb, Cu, Zn, Cd, Ni, Se, B, Cr, Cn), Pesticides and Radioactive material were never tested by the respective ROs. In addition to that, parameter such as Cyanide and Arsenic were also not tested in Kahn River. Some of the parameters[17] other than specified in the aforesaid notification were also tested by the respective ROs which increased the numbers

[15] Never tested in 17 results of Marethi and six out of 29 results of Hawankhedi.
[16] Total coliform 22 out of 29 results of Hawankhedi and 17 out of 19 test results of Marethi not found tested.
[17] Appearance, temperature, special conductivity, T-alkanity and fix dissolved solids, *etc*.

of tests.

MPPCB, while accepting the fact stated (December 2022) that the testing of parameters which was earlier left due to some reasons, had now been started as a measure of further improvement in monitoring work.

➢ Delays in testing by RO Dewas

As per water/wastewater sample collection guideline by MPPCB, the maximum storage time of sample (in respect of certain parameters to be tested) is as follows:

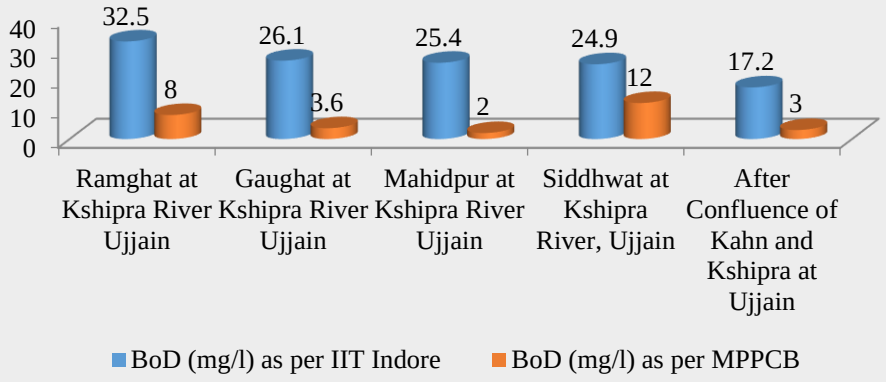
- Faecal Coliform and Total Coliform: 24 hours
- For Biological Oxygen Demand: six hours
- For Dissolved Oxygen: 15 minutes

Audit observed that in RO, Dewas, the samples were analysed after lapse of the stipulated testing times. The delays were observed in 26 out of 29 cases of Hawankhedi and in all the 19 cases of Marethi Confluence point during the period 2016-21. Since the quality of water changes with the passage of time, delay in adhering to the prescribed timelines for testing of water will impact the quality of tests conducted by the concerned office.

Audit further observed that the delays in testing were due to the fact that the RO, Dewas did not have a laboratory and the samples had to be sent to Ujjain for testing. Further, as per the prescribed guidelines, testing for dissolved oxygen and other parameters such as pH, chlorine, *etc*., had to be done in-situ (at the sample site itself), however, the RO, Dewas inexplicably failed to carry out in-situ tests after collection of samples, which indicated the casual attitude of the RO towards ensuring the integrity of the test sample.

➢ Comparison of BOD between the Test Reports of IIT Indore and MPPCB

Chart 3.1: Comparison of BOD between Test Reports of IIT Indore and MPPCB



It can be seen from **Chart 3.1**, that there is a huge difference in the test results of BOD conducted by IIT Indore and MPPCB. The BOD was in the range of 2 to 12 mg/l as per the test reports of MPPCB (March 2022) at five locations, however, the same was in the range of 17.2 to 32.5 mg/l as per the test reports of IIT Indore (March 2022). Hence, reliability of test reports of MPPCB is questionable.

3.5.3 Shortfall in achieving the targets set in Monitoring Package

There was a shortfall ranging from 7.75 to 33.57 *per cent* in the targets set under the Monitoring Package during the period from 2016-21.

The ROs of MPPCB prepare Monitoring Package for each year, in which, sampling stations and frequency of sampling in these stations are decided. The Monitoring Package is sent to MPPCB, Headquarters at Bhopal for approval and compliance of the same is done throughout the year. The Monitoring Package includes the targets for natural water monitoring at rivers, ponds/lakes, nalas, groundwater and trenching ground (ground water). The monitoring work is being conducted under the National Water Monitoring Programme and the State Water Monitoring Programme, *etc*.

It was observed that during the period 2016-17 to 2020-21, five monitoring packages were prepared and accordingly sampling and testing were done. The target and achievement for the monitoring packages in MPPCB is given in **Table 3.12.**

Table 3.12: Details of shortfall in monitoring packages

S.N.	Year	Ujjain			Indore			Dewas		
		Target	Achievement	Shortfall (*per cent*)	Target	Achievement	Shortfall (*per cent*)	Target	Achievement	Shortfall (*per cent*)
1	2016-17	680	456	33	375	328	12.5	54	17	68.52
2	2017-18	487	359	26	394	375	5	56	45	19.64
3	2018-19	503	457	9	448	437	3	56	43	23.21
4	2019-20	493	374	24	553	534	4	60	51	15.00
5	2020-21	715	529	26	682	588	14	60	34	26.67
Grand Total		**2,878**	**2,175**	**24**	**2,452**	**2,262**	**7.75**	**286**	**190**	**33.57**

(Source: ROs of MPPCB)

It can be seen from the **Table 3.12** that during the period of 2016-17 to 2020-21, the targets set for the monitoring of river water, pond/lake water, nala water and underground water were not achieved and there was an overall shortfall in the range of 7.75 to 33.57 *per cent*. It is pertinent to mention here that the station wise achievement was also not maintained by ROs, in absence of which, compliance of that specific point could not be ascertained by Audit.

MPPCB replied (December 2022) that the targets have not been achieved due to drying up of water bodies and non-approachability of sampling points due to rainy season.

The reply is not acceptable as location and time to collect samples from sampling points are decided by ROs themselves. If any sampling point is not accessible or River is drying in a particular period, then other location should have been taken for proper analysis of water quality in water bodies. Further, there was a shortfall of 7.75 to 33.57 *per cent* in achievement of the set targets by the MPPCB and the reply does not account for this shortfall.

3.5.4 Inadequate representation of Water Quality Index at Dewas, resulted in improper analysis for polluted river stretch

CPCB monitors the water quality in India under the National Water Quality Monitoring Programme. Water quality data is analysed and monitoring locations exceeding specified parameters are termed as polluted locations which are categorized from priority one to five on

the basis of severity of pollution. If any two continuous locations in the same water source are polluted, then the entire stretch between the two locations is defined as polluted river stretch.

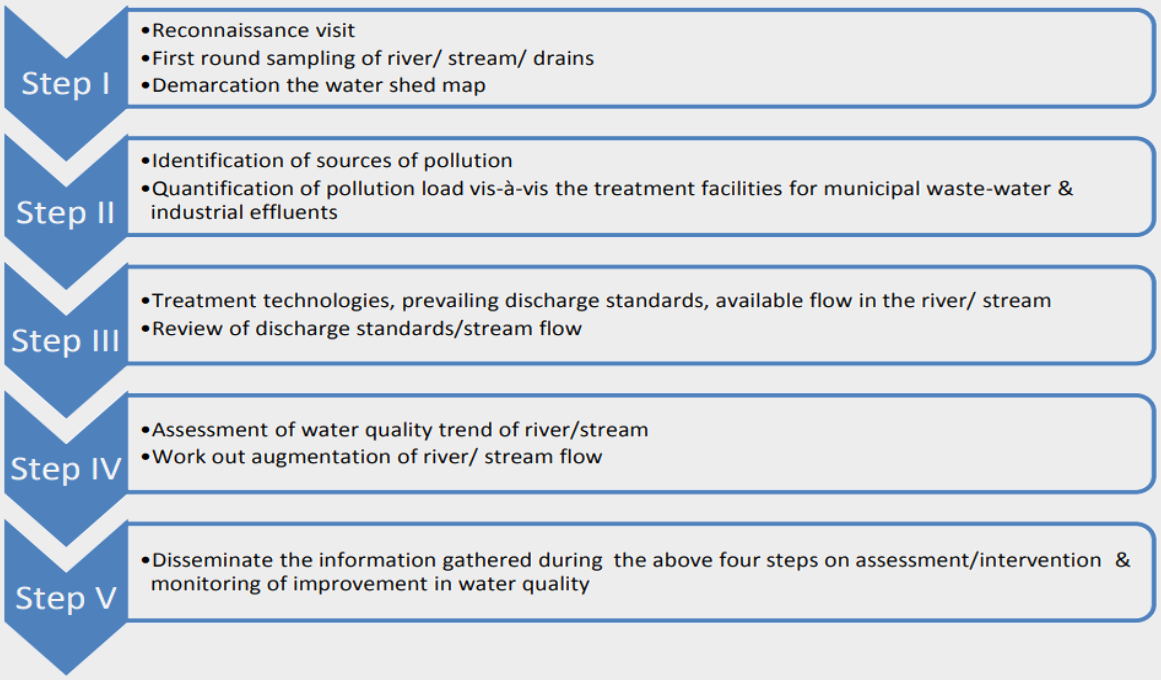
3.5.4.1 Non-inclusion of polluted river stretch

Kshipra River from Dewas (Hawankhedi) to Ujjain (Triveni Sangam) was not included in polluted river stretch despite water quality being below the prescribed standard.

As per CPCB's concept and plan for restoration of polluted river stretches, the river restoration action plans are designed for control of pollution and to restore the water quality of the river.

The restoration plan may **(Flow Chart 3.1)** have a number of steps as detailed below:

Flow Chart 3.1: River Restoration Plan by CPCB



(Source: Concept and plan for river restoration of polluted river stretches by CPCB)

As per above mentioned restoration plan, sampling and identification of polluted points are first step towards its restoration. Further, as per Sampling Point Guidelines 2017, sampling point should be before and after any city to show impact of that city and also at the confluence point of any water bodies.

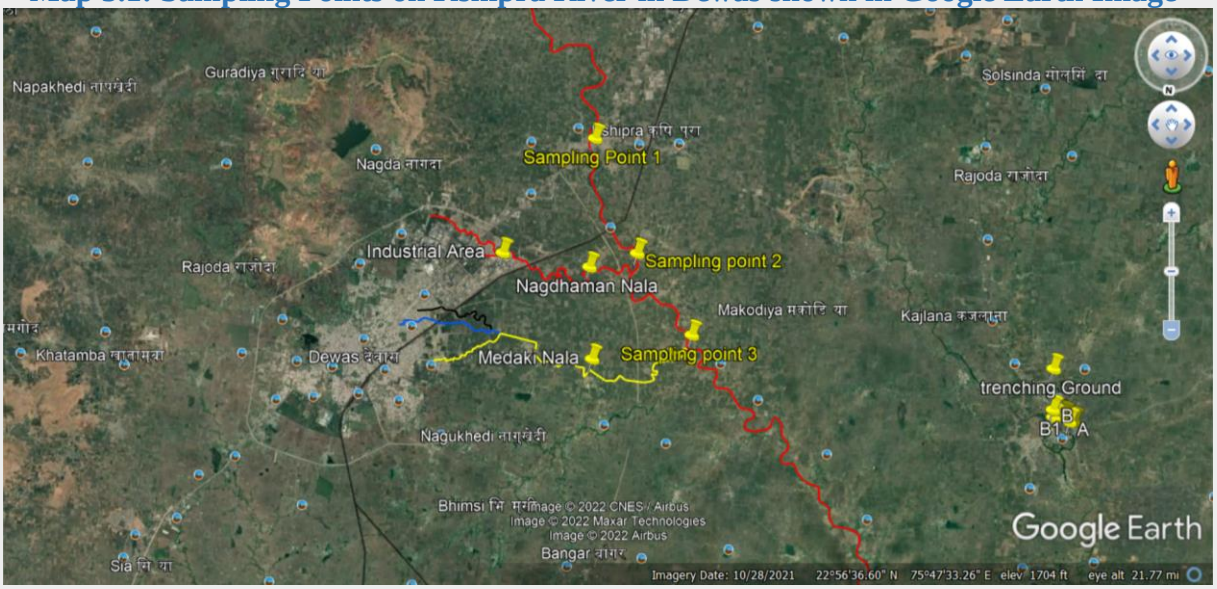
- **Details of Sampling Points on Kshipra River in Dewas**

1) **First sampling point** –Near Intake well at Kshipra River. Water quality of this point was in Category-A, having BOD less than 3mg/l as per MPPCB and IIT reports as well.
2) **Second sampling point**- At Hawankhedi after confluence of Nagdhaman Nala. Nagdhaman Nala passes through the industrial area of Dewas city and some other nalas of Dewas city also merge in it. This point shows the real impact of industrial waste as well as sewage discharge of the city on Kshipra River.

3) **Third sampling point-** At Marethi village after confluence of Mendki Nala. Dewas Nala and Bawadiya Nala of Dewas City merge into Mendki Nala. This point also shows impact of sewage discharge of the city on Kshipra River.

These sampling points are given in **Map 3.1.**

Map 3.1: Sampling Points on Kshipra River in Dewas shown in Google Earth Image



Following irregularities in testing were observed by Audit:-

Irregular Testing- First sampling point was being tested regularly on a monthly basis, while testing at second and third points was irregular. Details of testing done during the last five years are given in **Table 3.13.**

Table 3.13: Irregular testing at points 2 and 3 in Kshipra River, Dewas

S.N.	Year	Number of tests conducted		
		1st Sampling point	2nd Sampling point	3rd Sampling point
1	2016-17	12	4	2
2	2017-18	12	7	3
3	2018-19	12	5	3
4	2019-20	12	6	6
5	2020-21	12	5	3

(Source: MPPCB RO, Dewas)

As per Para 3 (j) of WQMG 2017, flux stations/ impact stations are those where impact on river stem due to human intervention at any point of time and is necessary for measuring impact of pollution control measures adopted. Hence, 2nd and 3rd sampling points should be classified as flux station and be tested twice in a month.

Audit noticed that this was not done by RO, Dewas. Hence, neither the impact of pollution control measure adopted was analysed by RO, nor the impact of Nagdhaman and Mendki nalas on River Kshipra was tested regularly.

➢ BOD not being tested

As per para 2.1 of 'River Stretches for Restoration of Water Quality Report by CPCB', BOD is one of the most important parameters on the basis of which any point is declared polluted

and if polluted locations are in continuous sequence, then that particular stretch is declared as polluted river stretch.

At 2nd sampling point, BOD was tested 29 times by MPPCB during the last five years and it was found to be above the prescribed limit on 16 occasions (from 3.6 mg/l to 18 mg/l).

At 3rd sampling point, sample for water testing was taken 19 times during last five years, but BOD was tested on only four times. BOD was not being tested on remaining occasions citing reasons such as non-approachable site and non-working of instruments. If BOD of 3rd sampling point had been tested regularly and was found above the prescribed limit, then entire river stretch of Dewas would have been declared as polluted river stretch.

RO, Dewas replied that Nagdhaman nala, merging point at Hawankhedi (2nd sampling point) and Mendki nala, merging point at Marethi (3rd sampling point) decide the water quality of Nala. It does not decide the water quality of Kshipra River.

Reply of the RO is factually not correct as testing of water is being done after 100 metre ahead of merging point of nala into the Kshipra for impact analysis of the nala water in the river. Further, during the past five years (2017-21), sampling and testing was done on seven occasions on the same dates from the 2nd and 3rd sampling points, but test results of BOD for 2nd point was declared on five occasions. However, results of BOD were not declared for 3rd point.

➢ Kshipra is polluted even before Kahn merges into Kshipra.

Kshipra River originates from Kokri Bardi hill near small village Ujjeni and after travelling 11 km (approximately), Kshipra River enters Dewas. At the entering point, testing is done by MPPCB near the intake well (1st sampling point). The water quality at intake well is Category – A which shows that the Water Quality of Kshipra River from its origin till entering Dewas is satisfactory.

However, at the 2nd and 3rd sampling points in Dewas, the test results are not satisfactory as discussed in the previous paragraph. Further, for the purpose of examining the water quality status of Kshipra River before Kahn merges into it, Audit had also conducted water analysis from IIT Indore.

Test results of three sampling points are detailed in **Table 3.14.**

Table 3.14: BOD at sampling points

S.N.	Location	BOD (mg/l)
1	At Kshipra Sukalya Village (1st Sampling Point)	1.3
2	At Hawankhedi (2nd Sampling Point)	27.6
3	At Dhediya before Khan merges into it (After 3rd Sampling point)	18.0

(Source: MPPCB)

It can be seen from above that the BOD of Kshipra River at 1st Sampling Point was satisfactory, however, at 2nd sampling point it is much higher. It is pertinent to mention here that as stated earlier, the BOD is not tested at the 3rd sampling point (due to the reason of non-approachability as stated by RO Dewas). Audit had conducted the testing after 3rd sampling point at Dhediya village through IIT and the result was not found satisfactory. This shows that two continuous points are polluted on Kshipra River and the sampling point at Dhediya should have been taken

as a replacement or in addition to 3rd Sampling point for ascertaining the water quality. These results also show that the Kshipra River is polluted even before the Kahn River merges into the Kshipra River.

MPPCB replied (December 2022) that the polluted river stretches are declared by CPCB.

However, no specific reply to the queries related to irregular testing and non-testing of BOD were furnished. Further, polluted river stretches are decided on the basis of the results of testing done by the MPPCB, but testing of most important parameter, *i.e.*, BOD along with river water was irregular.

3.5.5 Non-achievement of water quality target at the monitoring stations of polluted river stretches

Targets fixed by the NGT in 2018 for BOD and Faecal Coliform could not be achieved at polluted river stretches of Kshipra and Kahn Rivers.

NGT had instructed (September 2018) all States and Union Territories to prepare Action Plans within two months for bringing all the polluted river stretches to be fit at least for bathing purposes (*i.e.*, BOD < 3 mg/l and FC < 500 MPN/100 ml) within six months from the date of finalisation of the Action Plans, which was further extended to be completed by 31 March 2021.

Table 3.15: Details of BOD and Faecal Coliform in Kahn and Kshipra Rivers

S.N.	Name of Sampling Station	Parameter as on March 2021	
		BOD	FC
1	River Kahn at Sanwer	8	540
2	River Kahn at Kabitkhedi	17	1,100
3	River Kahn at Shakkarkhedi	15	470
4	River Kshipra at 1 km downstream near Triveni	3.2	12
5	River Kshipra at Ramghat	4.8	540
6	River Kshipra at Siddhawat	10	920
7	River Kshipra at Gaughat	3.4	14

(Source: WQI of the Madhya Pradesh Pollution Control Board)

It can be seen from the **Table 3.15** that at all the points as published in WQI by MPPCB, target of bathing standard (*i.e.*, BOD < 3 mg/l and FC < 500 MPN/100 ml) could not be achieved up to March 2021. Hence, the compliance of NGT's order regarding achievement of the objective of bathing standard in the river by 31 March 2021 was not ensured.

MPPCB replied (December 2022) that it is only monitoring the water quality of river and River Rejuvenation Action Plan is being implemented by the respective ULBs *i.e.*, Indore, Ujjain and Dewas.

The reply is not acceptable as being a monitoring agency of the State and being responsible for the implementation of the Action Plan, such denial regarding monitoring and implementation of Action Plan is escaping from the responsibility.

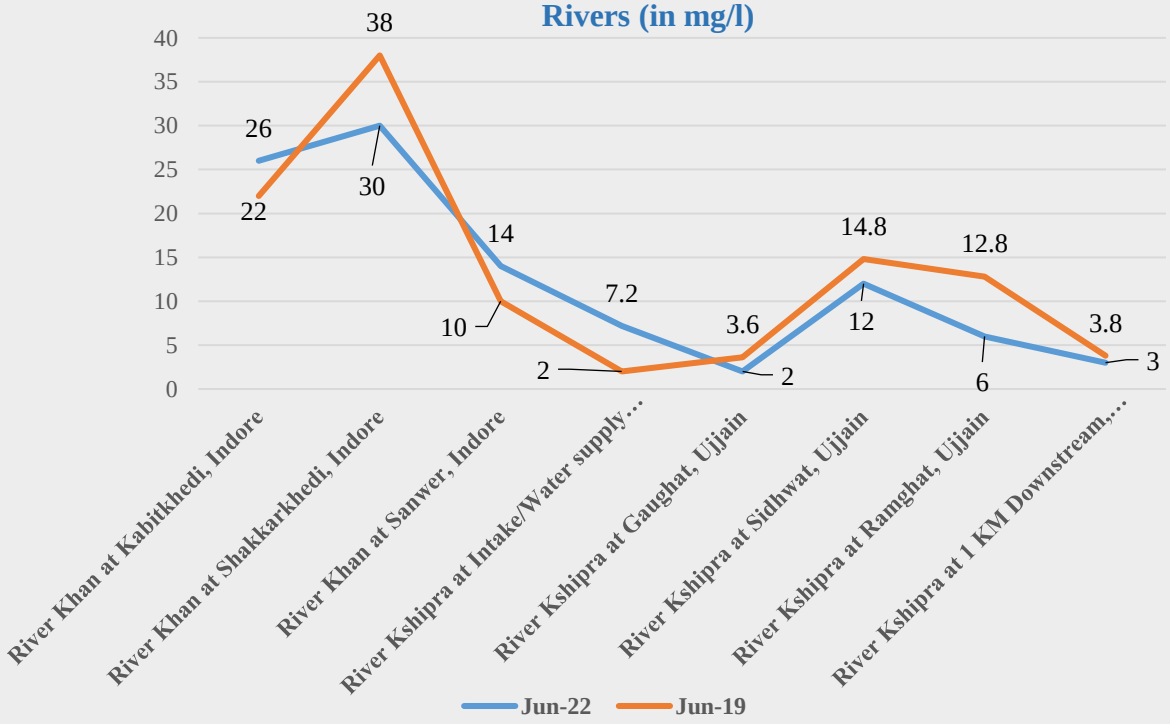
3.5.6 Non-achievement of water quality parameters

As per NGT's direction, all States and Union Territories were to prepare Action Plans within two months for bringing all the polluted river stretches to be fit at least for bathing purposes up to March 2021. Action Plans were to be prepared by four-member Committee called River Rejuvenation Committee (RRC)[18]. This Committee was supposed to be the Monitoring Committee for execution of the Action Plan. In Madhya Pradesh, RRC was formed in September 2018 and last meeting of RRC was held in June 2020. Since then, no further meetings were held up to June 2022.

In compliance with the Action Plan, MPPCB in its monthly progress report of May 2022, submitted to Ministry of Jal Shakti, stated that Kahn River which merges into Kshipra River, had been adopted as Model River for the State and will achieve bathing standards. In the 11th meeting (November 2021), Central Monitoring Committee (CMC) was also informed by State Government regarding success stories for revival of Kahn River.

But against the claim made by MPPCB, BOD, which is a major indicator of deciding status of water quality of River, was still much higher than the permissible limits. Comparison of BOD level at various monitoring stations on Kahn and Kshipra Rivers are depicted in **Chart-3.2.**

Chart 3.2: BOD levels at monitoring points of Kshipra and Kahn Rivers (in mg/l)



From the **Chart 3.2**, it is clear that in three out of eight monitoring points, BOD levels had increased since June 2019. Further, in seven out of eight locations (as on June 2022), BOD

[18] Comprising of Director Environment, MPPCB; Commissioner, Urban Administration and Development Directorate; Commissioner, Directorate of Industries and Member Secretary, MPPCB.

levels were higher than the bathing standards (which is <3mg/l).

Further, Central Monitoring Committee (CMC) which is monitoring the execution of Action Plan, in its 12th meeting stated (February 2022) that the functioning of existing STPs was reported satisfactory till last review (11th meeting November 2021), but water quality parameters of some STPs have now been reported to be beyond permissible limits. This indicates that STPs were not working as per required standard.

Conclusion: *The Minor Hypothesis was tested and was found to be true. As the frequency and parameters tested were not as per the WQMG and less number of parameters were being tested. Also, there was a shortfall in the achievement of the targets set in the monitoring package.*

Further, the compliance of the NGT's orders to maintain bathing standard of river water by March 2021, could not be achieved.

3.6 Minor Hypothesis No-11: There was Inadequate action against defaulting agencies.

Sections 33 and 33A of the Water (Prevention and Control of Pollution) Act, 1974 empower SPCBs to take action against the defaulting person/industries, which are likely to cause or have caused the pollution of the water in the stream or well.

The hypothesis was checked at three ROs of MPPCB, through various aspects, *i.e.*, penalisation of defaulting industries and testing of ground water, with respect to the impact of industries.

Findings on above hypothesis are discussed in detail as below:

3.6.1 Groundwater pollutant in industrial area near Kshipra River

As per study on groundwater, conducted by the Central Laboratory, MPPCB, Fe, Cd, Ni, Pb were high in most of the sampling points but no action was taken by MPPCB against defaulting Industries.

As per section 33 of Water Act, where it is apprehended by the Board that the water in any stream or well is likely to be polluted by reason of the disposal or likely disposal of any matter in such stream or well or in any sewer or on any land, or otherwise, the Board may make an application to a court, not inferior to that of a Metropolitan Magistrate or a Judicial Magistrate of the first class, for restraining the person who is likely to cause such pollution.

As per a study report (October 2020) on groundwater of various locations in Dewas Industrial Area, conducted by Central Laboratory, MPPCB, high contamination with reference to total dissolved solids, chlorides, fluorides, nitrate, sulphate, *etc*., in groundwater was observed in few locations of Dewas Industrial Area. The groundwater quality did not meet the standards, if compared with drinking water standard of BIS 10500 (2012). The deterioration of groundwater quality may be due to impact of industrial activities.

Status of groundwater quality of nine different locations (industries) of Dewas, as tested by the

MPPCB, are detailed in **Table 3.16**.

Table 3.16: Details of locations/ industries where groundwater was tested

(In mg/l)

S.N.	Monitoring Locations	Nitrate	Calcium	Sulphate	Iron	Cadmium	Nickel	Lead
	Acceptable limits	**45**	**75**	**200**	**0.3**	**0.003**	**0.02**	**0.01**
1.	M/s White Star Milk and Milk Products, Dewas	82.3	117	289	0.59	0.019	0.105	0.152
2.	M/s Tata International Ltd., Dewas	33.79	196	428	3.31	0.023	0.271	0.153
3.	M/s Raj Pioneer Laboratories (India), Dewas	70.61	245	545	0.58	0.023	0.114	0.168
4.	M/s Roca Bathroom Products Pvt. Ltd. (Parryware Industry), Dewas	39.08	220	720	0.70	Below Detection limit	0.105	0.316
5.	M/s VE Commercial Vehicle Ltd.Unit-II (Eicher), Dewas	50.1	128	275	0.39	0.017	0.094	0.149
6.	M/s Navin Fluorine International Ltd., Dewas	61	221	590	0.60	0.016	0.105	0.147
7.	M/s Krishna Food Products Ltd., Dewas	26.07	147	481	0.17	0.020	0.092	0.077
8.	M/s Kirloskar Brothers Ltd., Dewas	59.8	204	284	0.05	0.014	0.103	0.102
9.	M/s Bank Note Press, Dewas	11	37	151	0.09	0.011	0.112	0.062
No. of locations having parameters higher than acceptable limit		**5**	**8**	**8**	**6**	**8**	**9**	**9**

(Source: Madhya Pradesh Pollution Control Board Report)

It can be seen from the **Table 3.16** that parameters of Nitrate, Sulphate, Calcium, Iron, Cadmium, Nickel and Lead were above the permissible limit. Thus, sub-surface injection of chemicals and hazardous waste of industries has deteriorated groundwater quality in this area.

Study of groundwater in these industries was conducted by the MPPCB itself but action against defaulting industries was neither taken by the RO Dewas nor by the MPPCB headquarters, Bhopal under Section 33 of the Water Act.

MPPCB replied (December 2022) that in due course of time, the quality of groundwater of industrial area has improved due to installation of ETPs and reuse of treated wastewater in the processing, cooling and horticulture. The Board is taking all necessary steps to prevent groundwater pollution.

The reply is not acceptable as groundwater quality had deteriorated considerably due to specific industries as mentioned in the said study, but still no action was taken against the defaulting industries by MPPCB.

3.6.2 Water analysis conducted by IIT Indore

The Water analysis for crosschecking the test results of various parameters was conducted (March 2022) by Indian Institute of Technology (IIT), Indore. The sampling was carried out from 21 locations to determine the water quality parameters for assessing the quality of inland surface water and wastewater across Indore, Dewas, and Ujjain regions. The sampling for

surface water was carried out from Kahn and Kshipra rivers.

From the tests, the following was observed (***Appendix 3.1***):

- The DO level at five locations out of 21 locations was less than three mg/l and there were four treated wastewater samples where dissolved oxygen is zero or nearly zero. Dissolved Oxygen is the concentration of oxygen present in the water which is required for sustaining the life of aquatic organisms and ecosystems.

- The BOD and COD are the associated parameters which indicate the amount of oxygen required for the complete degradation of organic, combined organic and inorganic pollutants present in the water sample. COD limit at four locations out of 21 locations was above the acceptable limit of 250 mg/l and BOD limit at 15 locations out of 21 locations was above the acceptable limit of < 3mg/l.

Comparison of results of BOD between Indian Institute of Technology, Indore and MPPCB yielded gaps as all BOD results of MPPCB were extremely low as compared with IIT, Indore (**Details in Paragraph 3.5.2**).

- The presence of Faecal Coliform indicates faecal contamination of the water sample. Faecal Coliform at two locations out of 21 locations was above the acceptable limit of < 500 mg/l.

- In all the sampled locations, nitrite was well above the acceptable limit. The nitrite content indicates presence or discharge of agriculture fertilizers, human waste, sewage mixing, and poor treatment of wastewater in the water sample. The higher nitrite loading in the collected water samples indicates the chances of eutrophication which can degrade water quality and aquatic ecosystem in the future.

- Phosphate at all 21 locations was above the acceptable limit of < 0.1mg/l. Phosphorous in the water comes through agriculture and industrial discharge, soil leachate, leaves, *etc*. Higher phosphorus levels can cause algal blooms or eutrophication, which can impact aquatic organisms and human health due to the release of algal toxins and less dissolved oxygen.

- Further, all the collected samples came out free from any pesticides; the absence of pesticides in the water samples indicates that industrial and domestic discharge is more prominent in polluting the rivers as compared to the agriculture discharge in the sampled regions.

Conclusion: *The Minor Hypothesis was tested and was found to be true. The parameters were very high in the groundwater, but no action was taken against the defaulting industries by MPPCB. Further, as per the Report of IIT Indore, numerous parameters were not within the acceptable limits.*

3.7 Recommendations

Audit recommends that:

- MPPCB may formulate a plan for timely issuance of the consent and develop a mechanism for ensuring that industries are having an active consent.

- MPPCB may ensure the achievement of the targets of inspections of Industries and the targets set in the Monitoring Package. MPPCB may ensure installation of ETPs and water meters by Industries.
- MPPCB may ensure compliance to the Water Quality Monitoring Guidelines and may identify and develop a mechanism to bring the water quality parameters within the acceptable limit.
- Mechanism may be strengthened so that elements affecting the water quality of Kshipra River are eliminated.
- Responsibility for allowing industries to operate without consent and lack of monitoring/ inspections by the Officers concerned may be fixed by MPPCB.

CHAPTER 4

POLLUTION ALONG RIVERBANKS

4 CHAPTER

Pollution along Riverbanks

Sub-Major Hypothesis No-3: Water Quality of Kshipra and its tributaries has been adversely affected due to pollution at Riverbanks.

4.1 Introduction

The Kshipra is one of the sacred rivers in India. The ancient city of Ujjain is situated on the banks of Kshipra River. Many famous Ghats, such as *Ram Ghat, Mangalnath Ghat*, *Siddhawat Ghat* and *Triveni Ghat*, having religious and historical importance, are situated along the banks of Kshipra River in Ujjain. Many religious activities undergo regularly on these Ghats and hundreds of pilgrims visit the city for taking a dip in the river along these *Ghats*.

However, due to unregulated activities along Ghats of Kshipra River, condition of Kshipra River is getting deteriorated day by day.

According to NGT's order[1] (September 2018), each State had to prepare an Action Plan for Polluted River Stretches (reference Paragraph 3.1). The Action Plan was to *inter alia* include protection and management of Flood Plain Zone[2] (FPZ).

4.2 Minor Hypothesis No-12: There is an improper management of Flood Plain Zone by Urban Local Bodies.

The hypothesis was checked through various aspects viz. managing the FPZ, execution of encroachment removal work, river front development and plantations along the FPZ of the rivers.

Findings on the above hypothesis are discussed below.

4.2.1 Non-preparation of guidelines of Flood Plain Zone along the river.

Declaration of FPZ along the river was done by Town and Country Planning (T&CP) in Ujjain and Indore districts, but appropriate Guidelines for the FPZ were not formed by the ULBs for regulation of FPZ.

The NGT's order (September 2018) stated that Action Plan for Polluted River Stretches should include the work of regulating activities in, Management of Municipal Solid Waste and should

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1 Case No. 673/2018 (*suo- moto* judgement passed by NGT on the basis of newspaper report).

2 Land area susceptible to being inundated by water from flood along river.

also include plantations for greenery development.

Further, setting up of Biodiversity Parks on flood plains by removing encroachments shall also be considered as an important component for river rejuvenation. As per the Action Plans for rejuvenation of Kshipra and Kahn Rivers (2018), solid waste dump should be removed from the FPZ and construction activities on the flood plains should be stopped.

Audit observed that the ULBs, Ujjain and Indore had not prepared any guidelines relating to FPZ, and no work related to bio-diversity had been executed on FPZ. Due to this, un-authorised constructions and encroachment on the riverbanks were observed, as discussed in the subsequent Paragraphs.

The UDHD replied (January 2023) that in case of ULB, Ujjain, the recommendations are under consideration.

4.2.2 Encroachments along banks of Kahn and Kshipra Rivers.

Encroachments were observed in three out of six ULBs in the FPZ of Kahn (Indore and Sanwer) and Kshipra Rivers (Ujjain).

According to the Development Plan of Ujjain and Indore cities, prepared by the Directorate of Town and Country Planning, Madhya Pradesh, areas within 200 metres on both sides of Kshipra River in Ujjain and areas within 30 metres of both sides of Kahn River in Indore and Sanwer were declared as FPZ, and construction activities in these areas were prohibited. Further, under Rule-7 of Bhumi Vikas Niyam, 2012, if any illegal construction is observed within these areas, the Building Officer in the respective ULB was authorised to remove them.

As per NGT's order[3] (September 2018), identification of encroachments alongside the river as well as its removal is necessary for effective implementation of Action Plans for Rejuvenation of Kahn and Kshipra Rivers. Identification of encroachment and its removal was included in Action Plans for Rejuvenation of Kahn and Kshipra Rivers accordingly.

Kshipra River passes through Ujjain and Mahidpur ULBs of Ujjain district, and its tributary Kahn River passes through the Municipal areas of ULBs, Indore and Sanwer.

In ULB, Ujjain, at least seven clusters of encroachments/constructions within 200 metres on both side of river while in case of ULBs, Indore and Sanwer, at least 15 locations (where encroachments/ constructions had been carried out within 30 metres on both side of river) were detected through Google Earth. Details of encroachments/ constructions seen in Google Earth images of Kshipra and Kahn Rivers are given in **Table 4.1** and Google Earth images of illustrative cases have been reproduced in **Images 4.1 and 4.2**. Details of coordinates are given in ***Appendix 4.1***.

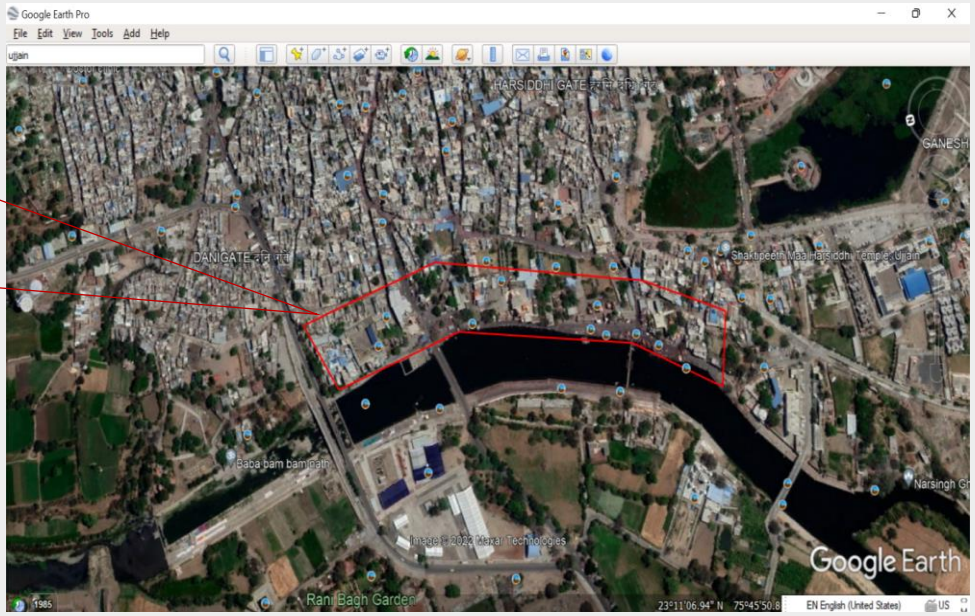
[3] Case No. 673/2018.

Table 4.1: Details of constructions/encroachments in FPZ of the Kahn and Kshipra Rivers

S.N.	Name of ULBs	Name of River	Construction/ Encroachment observed
1	Ujjain	Kshipra	Encroachment/constructions in at least seven clusters
2	Indore	Kahn	Un-authorised constructions in at least 12 locations
3	Sanwer	Kahn	Un-authorised constructions in at least three locations

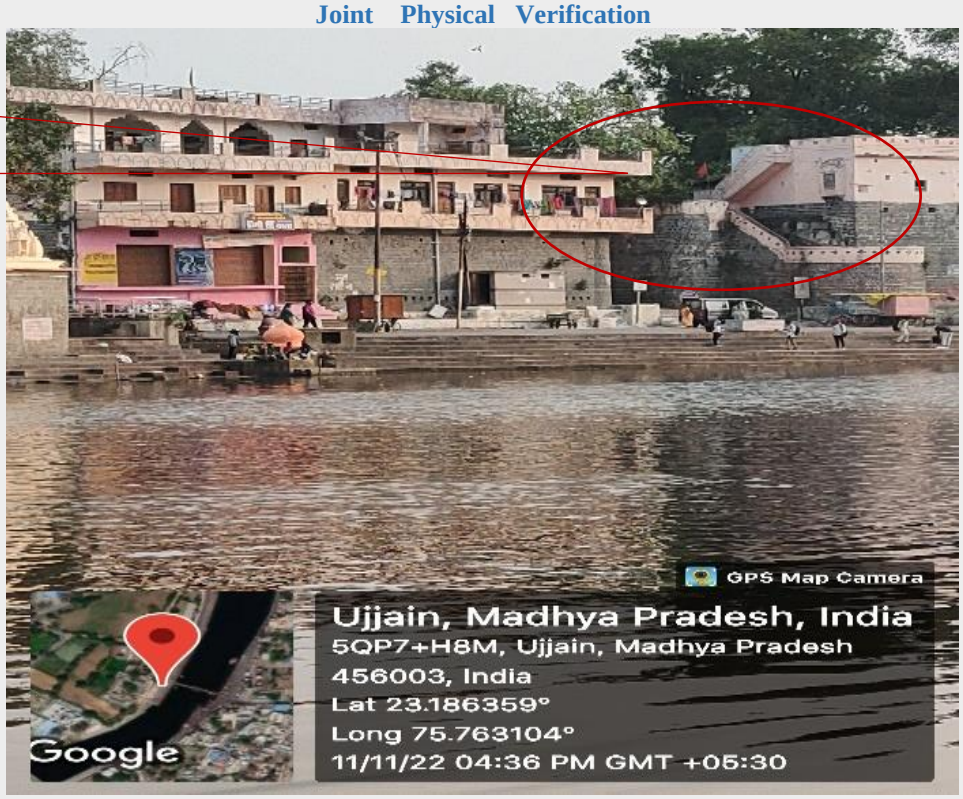
Image 4.1: Google Earth image of Ramghat, Ujjain depicting (Red lines) cluster of construction/encroachment near Kshipra River

Google Earth image of Ramghat, Ujjain depicting (Red lines) cluster of construction/ encroachment near Kshipra River.



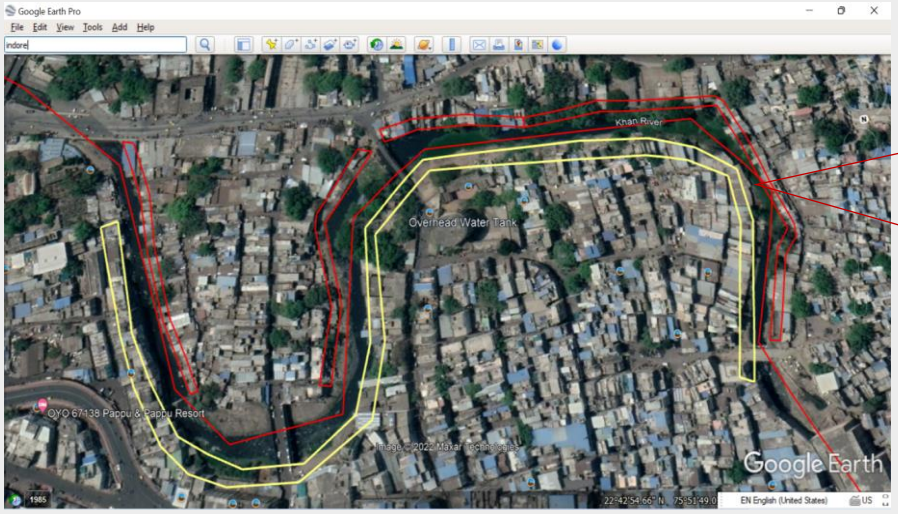
Images 4.2 and 4.3: Showing encroachment along Kshipra River at Ramghat during Joint Physical Verification

Residential encroachment along Kshipra River at Ramghat, Ujjain.



Residential encroachment along Kshipra River at Ramghat, Ujjain.

Image 4.4: Google Earth image of Kahn River in Indore near Serwate Bus Stand depicting construction/encroachment with red and yellow lines

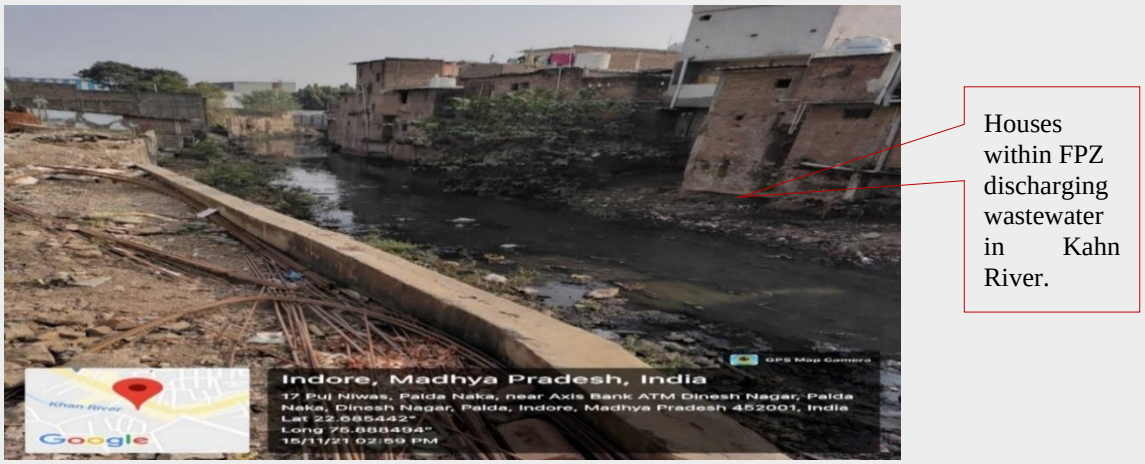


Encroachment along Kahn River in Indore near Serwate Bus Stand (depicting construction/ with red and yellow lines).

Image 4.5: Joint Physical Verification at ULB, Indore showing construction of shops inside Kahn River itself (Shops built by ULB itself)

Encroachment/ construction of shop inside Kahn River itself (Shops built by ULB itself).

Image 4.6: Showing encroachment and merging wastewater in the Kahn River



Physical verification and Google Earth images above indicated encroachments along the Kshipra and Kahn Rivers within the FPZ.

- In addition to encroachment identified by Audit as mentioned in **Images- 4.4 to 4.6**, ULB, Indore had also identified (October 2018) 2,917 families (slums dwellers) illegally residing alongside rivers. Out of these, encroachments of 141 families have been shown as evicted by the ULB, Indore since 2018.
- In compliance with NGT's directions, RO, PCB Ujjain mentioned (in the Action Plan) that all encroachments/constructions had been evicted by local administration. However, satellite imaginary **(Image 4.1)** clearly shows illegal encroachment.

Thus, effective implementation of the River Rejuvenation Plans as well as NGT's instructions regarding abatement of pollution from the rivers could not be ensured due to non-removal of encroachments from the riverbanks as wastewater from encroachments is still polluting the River as shown in **Image 4.6**. As a result, water quality parameters of Kahn and Kshipra Rivers could not achieve the targeted standards as mentioned in Paragraphs **3.5.5 and 3.5.6** *ante*.

The UDHD replied (January 2023) that it had been ensured that there is no encroachment along the river within 200 metre and removal of illegal construction was being done, if any, in ULB, Ujjain. Whereas, in case of ULBs, Indore and Sanwer, the reply was silent.

The reply is not acceptable as encroachment is clearly visible as is shown in **Images 4.1-4.6**.

➢ Existence of brick kilns in the Flood Plain Zone of the Rivers

As per Rule 3 (iii) of Madhya Pradesh Minor Mineral Rules, 1996, no quarry shall be done within a distance of 100 metres from a bridge, national/state highway, railway line, public place, riverbank, nalas, canal, reservoir dam, any natural water course or any water impounding structure. Further, as per the Development Plan of Indore City, 30 metres land on either side of River Kahn is ear-marked as "Green Belt", where construction activity is not allowed.

Out of six[4] ULBs, in Mahidpur and Sanwer, brick kiln construction activities were observed

[4] Mahidpur, Sanwer, Indore, Ujjain, Alot and Dewas. Whereas Kshipra and its tributary Kahn River are not passing through Alot and Dewas municipal area, which has not been looked upon for brick kiln activities.

within FPZ during physical verifications as well as through Google Earth images. Permission for these brick kilns was not accorded by the Mining Officers of the districts concerned. Details are given in **Table 4.2.**

Table 4.2: Status of brick kilns along Kahn and Kshipra Rivers

S.N.	Name of ULBs	Name of River	Illegal Construction/ Encroachment and Brick Kiln along River
1	Mahidpur	Kshipra	Brick kilns near Kshipra River.
2	Sanwer	Kahn	Brick kilns at two locations.

(Source: Selected ULBs)

Image 4.7: Brick Kiln along the Kahn River at Sanwer noticed during Joint Physical Inspection

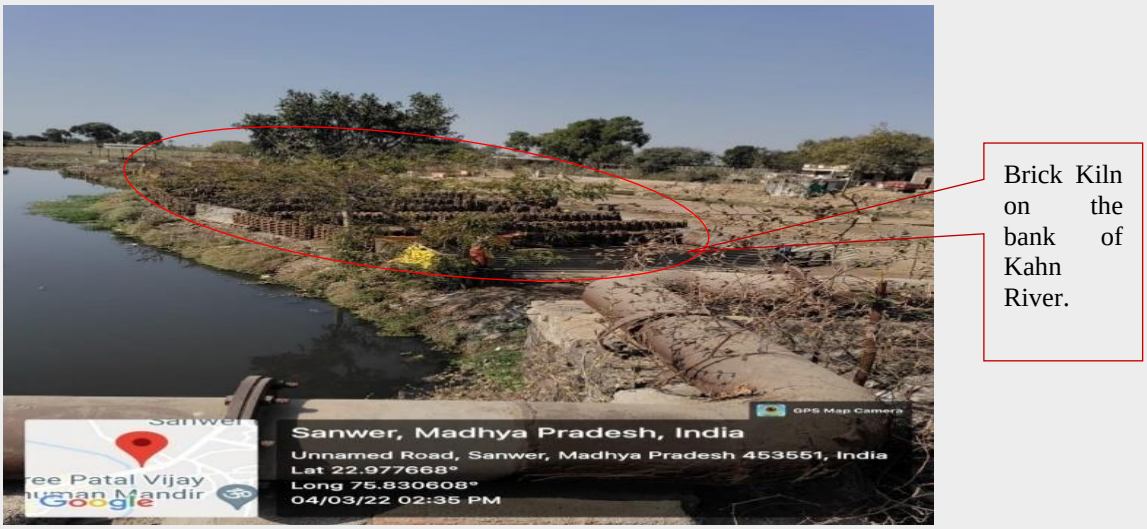
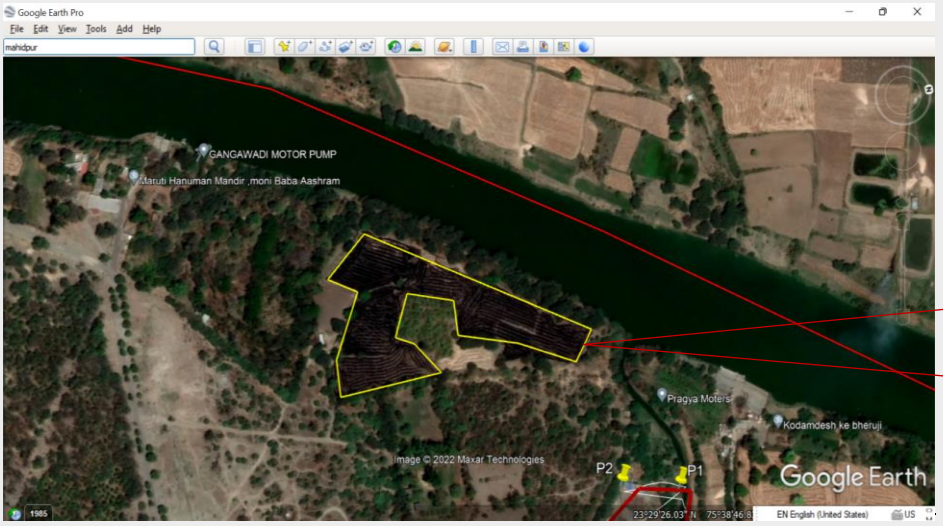


Image 4.8: Brick kilns in Sanwer, as shown in Image 4.7, is also shown via Google Earth

Image 4.9: Google Earth image of brick kiln at the bank of Kshipra River in Mahidpur



Google Earth image of Brick Kiln on the bank of Kshipra River.

Thus, the ULBs failed to monitor illegal encroachments along Kahn and Kshipra Rivers and to take effective steps to remove these encroachments, which in tantamount to dereliction of duty.

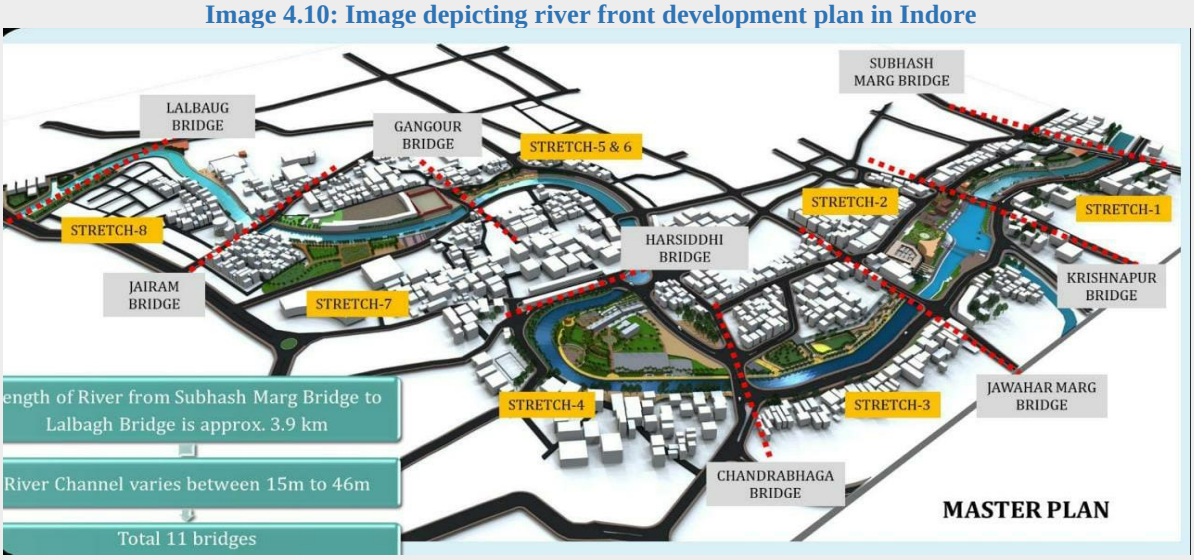
4.2.3 Improper execution of River Front Development works.

Action Plan for rejuvenation of Kahn and Kshipra Rivers, prepared by the MPPCB, includes development and management of river front alongside of Kshipra and Kahn Rivers.

➢ River Front Development alongside Kahn River in Indore

In compliance to the Action Plan for Rejuvenation of Kahn River, river front development work was taken under the Indore Smart City Project in eight stretches comprising a total length of 3.9 km, as shown in **Image 4.10**.

Image 4.10: Image depicting river front development plan in Indore



(Source: ULB, Indore)

Status of river front development works undertaken in the eight stretches alongside the Kahn River are as shown in **Table 4.3**.

Table 4.3: Status of river front development works alongside the banks of Kahn River, Indore

S. N.	Name of Riverfront	Project Name	Agreement cost (₹ in crore)	Financial progress (₹ in crore)	Status of work	Status of encroachment
1	River Stretch 01	Rambag Bridge to Krishnapura Bridge	3.57	3.45	Work Completed	Encroachments were completely removed.
2	River Stretch 02	Krishnapura Bridge to Jawahar Marg	26.65	24.60	92 *per cent*	Partial encroachment removed.
3	River Stretch 03	Jawahar Bridge to Chandrabhaga Bridge	2.18	0.15	23 *per cent*	Partial encroachment removed.
4	River Stretch 04	Chandrabhaga Bridge to Harsiddhi Bridge and Harsiddhi Park	4.42	2.47	Work completed	No encroachment exists.
5	River Stretch 05 and 06	Harsiddhi Bridge to Gangour Bridge	7.86	2.45	31 *per cent*	No encroachment has been removed.
6	River Stretch 07	Gangour Bridge to Jairam Bridge	9.34	9.18	98 *per cent*	No encroachment has been removed.
7	River Stretch 08	Jairam Bridge to Lal Bagh Bridge	9.75	2.75	28 *per cent*	No encroachment has been removed.

(Source: Indore Smart City Development Limited)

It is evident from the **Table 4.3** that river front development work could not be completed in six out of eight stretches due to encroachments alongside River Kahn and its tributary. Due to this, the execution of river front development work, which was to be completed by June 2021, was yet to be completed till December 2022.

➢ River front development work alongside Kshipra River in Ujjain

Kshipra *Haritima* Abhiyan was a project planned to be taken up in Ujjain under the Green Corridor Plan (as per river front development work of Kshipra River). The project was to be executed by the Forest Department of GoMP and included the works of intensive plantation on both banks of Kshipra River, development of natural habitats for birds, construction of pedestrian walkway, watch tower, cycle track, and development of eco-tourism infrastructure. Funds for the project were to be released by the ULB, Ujjain to the Forest Development Agency under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT[5]).

Audit observed that an amount of ₹ 3.82 crore was provided to the Forest Department by the ULB, Ujjain for these works on various dates between August 2018 and January 2020. Details of release of payments are given in **Table 4.4.**

[5] AMRUT aims that every household has access to assured supply of water and a sewerage connection; developing greenery and open spaces (parks) in the cities; reduce pollution by switching to public transport or facilitating non-motorized transport, *etc*.

Table 4.4: Details of payment made for river front development and plantations

S.N.	Date of release	Amount released (₹ in lakh)
1	August 2018	159.00
2	November 2018	200.00
3	January 2020	23.00
Total		**382.00**

(Source: ULB, Ujjain)

Forest Department provided an abstract of expenditure for various works like, plantations, fencing, advertisements, gazebo, pathway, flex board and other works. However, the details of works to be executed, location of these works, procedure to be adopted for execution of these works were not provided by the Forest Division, Ujjain. All these works were measurable items, but details were not found along with Utilisation Certificates (UCs) of the Forest Department. ULB, Ujjain had not asked Forest Division to submit Measurement Books of such work even though UCs not self-sufficient to assure that actual quantum of work was executed. Therefore, ULB, Ujjain failed to provide the records to show the details of work executed under the River Front Development.

The UDHD replied (January 2023) that in case of ULB, Ujjain, approximately one lakh plants from the AMRUT funding (₹ 3.82 crore) had been planted under Haritima Project near the riverbanks of Kshipra and no comments were offered in case of ULB, Indore.

Reply is not acceptable as no details of various expenses of already executed river front development work were provided. Further, shortcomings on plantations, relating to Indore and Ujjain districts are also discussed in **Paragraph 4.2.4**.

4.2.4 Shortcomings in Plantation at River banks/Flood Plain Zones by the ULBs

There were shortcomings in the plantation work, carried out by ULBs, Indore and Ujjain.

Audit observed that in compliance to NGT's directions (September 2018), plantation work in FPZs of Kshipra and Kahn Rivers had been executed by two ULBs (Indore and Ujjain) through Indore and Ujjain Forest Divisions respectively. Details of plantations along Kahn and Kshipra Rivers are mentioned in **Table 4.5**.

Table 4.5: Details of Plantation along Kahn and Kshipra Rivers

S.N.	Name of District	Location of plantation	Number of locations proposed for plantation	Number of plantations Proposed
1	Indore	Old plantation work along Kahn and its tributary Saraswati	7	66,000
		New plantation work along Kahn and its tributary Saraswati	7	27,500
2	Ujjain	Ujjain North	9	50,000
		Ujjain South	5	50,000
Total			28	1,93,500

(Source: Selected ULBs)

Out of the above 1,93,500 plants, 93,500 were to be planted along Kahn and Saraswati Rivers

while 1,00,000 plants were to be planted along Kshipra River. Location-wise plantations are detailed in ***Appendix 4.2***. Audit observed the following:

➢ Improper reporting of plantations

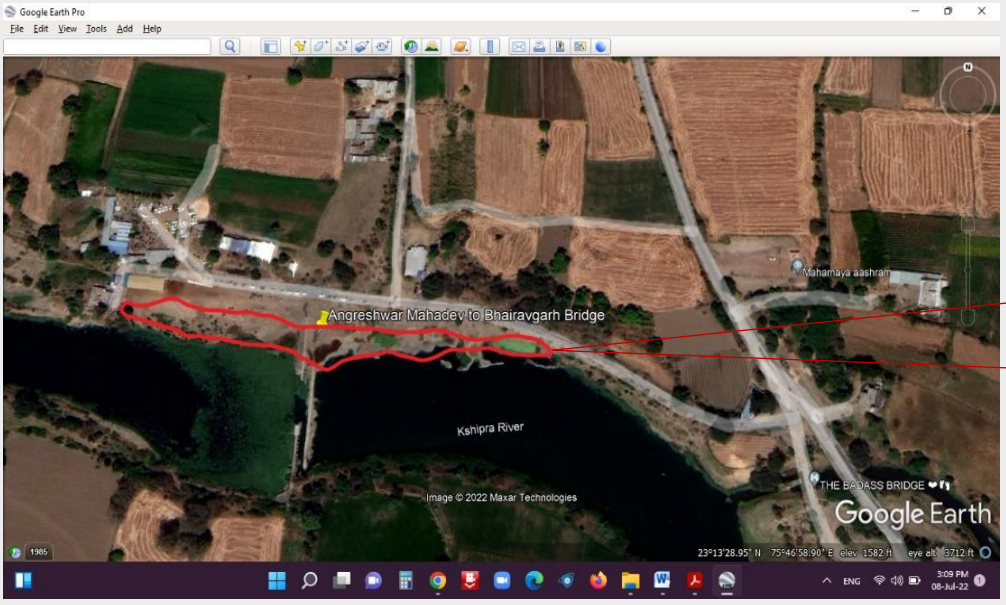
As per the plan prepared by ULB, Ujjain, 14 sites alongside of Kshipra River were selected for the targeted plantation of one lakh plants. As per the completion report submitted by the Forest Department to ULB, Ujjain, one lakh plants had been reported as planted, but examination of related records revealed that the actual plantation done was only 78,800. This had resulted in short plantation in the FPZ of Kshipra River. Hence, reporting of achievement of target of one lakh plantation is evidently incorrect and misleading. The situation occurred due to the failure of the ULB to monitor the work being carried out by the Forest Department on its behalf.

➢ Doubtful plantation work

In compliance with NGT's order (September 2018) regarding plantation at riverside of Kahn and Kshipra Rivers, ULBs, Indore and Ujjain had allotted works to respective Forest Divisions at 28 sites alongside the Kahn and Kshipra Rivers.

Audit observed from the Google Earth images (December 2021 and May 2022) that in eight out of these 28 sites, no plantation was found. Details of these eight locations are detailed in ***Appendix 4.3,*** one location is referred in ***Image 4.11***. The project implementation period of the eight sites was between 2018-19 and 2020-21.

Image 4.11: Google Earth image depicting no plantation activity in one of the sites



ULB, Indore accepted the fact and stated that work on the above-mentioned sites had not been executed as per programme. However, the reply was silent about the remedial action taken/proposed to be taken.

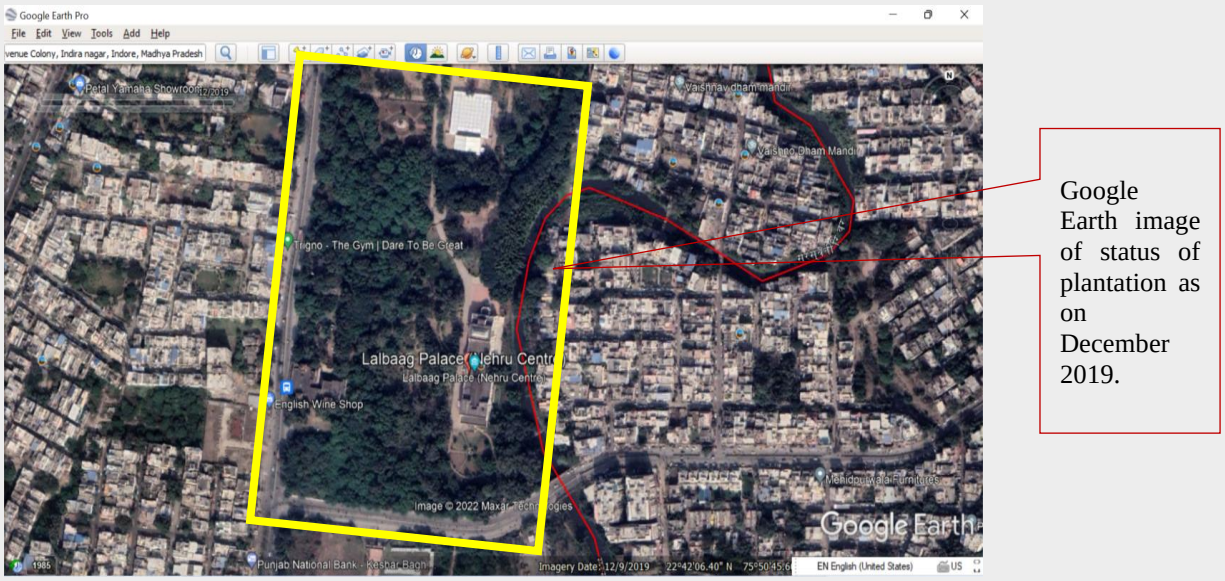
➢ Incorrect selection of plantation sites

As per the general condition of sanction of the plantation projects, it was the duty of Forest Officer to conduct physical verification of site and give certificate regarding the site and accordingly Project Report for the plantation was to be prepared and Technical Sanction was

to be issued by the Forest Division, Indore (July 2021).

Audit observed that the physical verification of the sites was conducted by the officials of the Forest Department. The Deputy Commissioner, ULB, Indore also accorded sanction to these sites accordingly. However, on verification of the plantation sites through Google Earth, Audit observed that there was already an existence of dense plantations at two[6] sites as detailed in ***Appendix 4.4.*** Therefore, the selection of these two sites for plantation was not correct and resulted in wasteful expenditure. One such case is highlighted in **Image 4.12.**

Image 4.12: Google Earth image depicting existing plants in yellow outline in site at Lalbagh as of December 2019 before working program for plantation



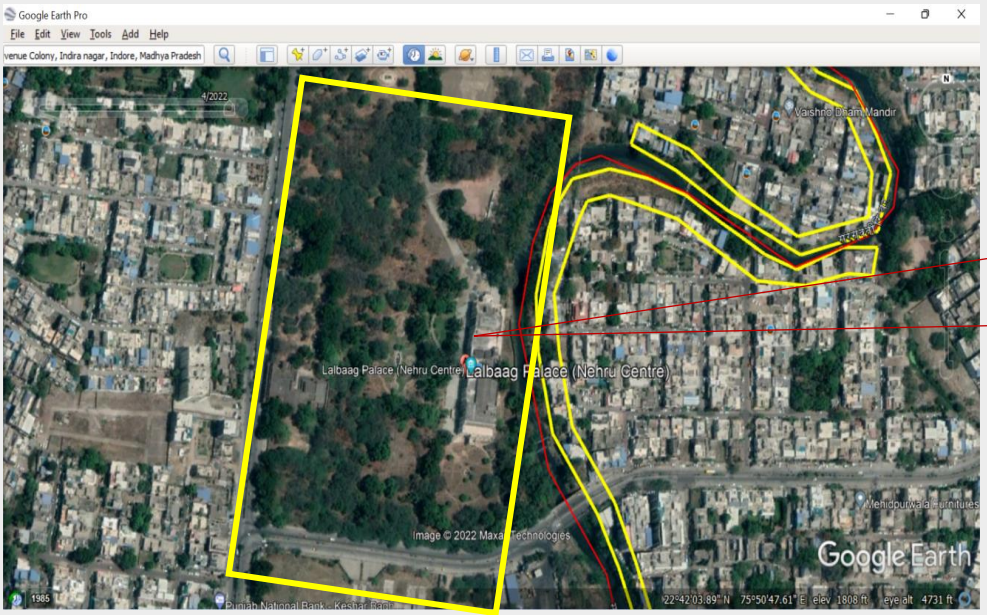
The ULB, Indore stated that plantation works had been executed in two locations.

Reply is factually incorrect as:

- The sites already had dense plantations in December 2019 (as proved by **Image 4.12**), much before the new plantations could have been carried out.
- The ULB failed to provide relevant records in support of its reply that plantations had been carried out.
- Latest Google Earth **Image 4.13** indicates no change in plantation status between September 2019 and April 2022.

[6] Laal Bhag behind Vaishno Devi temple and (GTS), Laal Bhag Magar Kuwa.

Image 4.13: Google Earth image depicting current position of plantation in yellow outline at Lalbagh as of April 2022



Google Earth image of status of plantation as of April 2022.

***Conclusion**: The Minor Hypothesis was tested and found to be true. It was observed that guidelines regarding regulations in FPZ were not issued by ULBs and encroachments were observed in the FPZ of Kahn and Kshipra Rivers. Lesser numbers of encroachments were removed against the ones actually existed. River Front Development was not executed properly. Plantation work was doubtful; reporting of plantations and selection of sites were not correct.*

4.3 Minor Hypothesis No-13: Solid waste was disposed at River banks due to improper implementation of Solid Waste Management by ULBs.

The observations of audit on the issues, *i.e.*, disposal of solid waste as per the Solid Waste Management Policy of the State and efforts taken by the ULBs towards the Government of India's mission "Waste to Wealth", are discussed in paragraphs below:

4.3.1 Disposal of Solid Waste as per Solid Waste Management Policy of state was deficient.

Solid waste was being discharged through drains in all the ULBs, contributing towards pollution in the Kahn and Kshipra Rivers.

As per clause 2.2.1 of Municipal Solid Waste Management Manual Part-II, no waste generator shall throw, burn or bury the solid waste generated by him, on streets, open public spaces outside his premises or in the drains or water bodies.

The ULBs are incurring significant expenditure on different activities involving awareness, door to door collection, processing of solid waste and cleaning and management of trenching grounds.

Audit carried out Joint Physical Inspection[7] at various locations around nine out of 28 nalas, water bodies and Rivers, passing through four[8] ULBs to ascertain the efficiency of solid waste disposal mechanism in these ULBs. The findings are shown below:

➢ ULB, Indore

Saraswati River and six[9] major nalas are merging in Kahn River, which ultimately merges into Kshipra River. Physical verification during audit was done at Kahn River and *Palasiya Nala*, the results are given in **Images 4.14 and 4.15**:

Images 4.14 and 4.15: Solid waste disposal in to Palasiya nala and Kahn River

Plastic and solid waste deposited in nala in Indore.

Solid waste deposited along Kahn River in Indore.

7 Dewas, Ujjain, Mahidpur and Sanwer.

8 Dewas, Indore, Mahidpur and Sanwer.

9 Ajadnagar Nala, Bamhori Nala, Palasiya Nala, Pipliyakhal Nala, Narwar Nala and Tulsinagar Nala.

Images 4.16 and 4.17: Photographs captured during Physical Verification of water bodies in ULB, Indore depicting large number of solid waste pollutants

➢ ULB, Mahidpur

There is one major nala in Mahidpur named as *Bada nala* in which small drains of Mahidpur merge and this ultimately merges into Kshipra River. Photographs captured during Joint Physical Verification of *Bada Nala* are shown below.

Images 4.18 to 4.21: Photographs captured during Physical Verification of Bada Nala at ULB, Mahidpur showing huge amount of solid waste pollutants

Nala in Mahidpur filled with plastic and solid waste.

Drain in Mahidpur showing discharge of waste water from households filled with plastic and solid waste.

Drain in Mahidpur filled with plastic and solid waste.

Plastic and solid waste deposited at the bank of nala in Mahidpur.

➢ ULB, Sanwer

There are six major nalas along with Katkiya River that merge into Kahn River. Photographs of Joint Physical Verification at Kahn River in ULB, Sanwer have been shown below:

Images 4.22 and 4.23: Images captured during Physical Verification of Kahn River in ULB, Sanwer showing solid waste pollutants in water bodies

Plastic and solid waste deposited at bank of Kahn River in Sanwer.

Plastic and solid waste deposited at bank of Kahn River in Sanwer.

➢ ULB, Dewas

There are 20 small drains in ULB, Dewas which ultimately merge into two major nalas named Nagdhaman Nala and Marethi Nala. These nalas ultimately merge into Kshipra River.

Images 4.24 and 4.25: Images captured during Physical Verification of Nagdhaman Nala at ULB, Dewas showing solid waste pollutants in the water body

It is evident from the above that in violation of Municipal Solid Waste Management Manual, the solid waste was flowing through the drains/water bodies in above ULBs. However, no actions were taken in this regard by the concerned ULBs, despite huge expenditure on the processing of solid waste.

No reply is received in this regard (February 2023).

4.3.2 Efforts made by the State Government towards 'Waste to Wealth' mission

Out of six ULBs, Waste to Wealth was implemented by ULBs Indore and Dewas only.

The Ministry of Housing and Urban Affairs, GoI prepared a Ready Reckoner for "Waste to Wealth" Management as an initiative under the Swachh Bharat Mission. The ready reckoner suggests two alternatives (1) Waste to Compost and (2) Waste to Energy for the purpose.

Details of wealth generations from municipal waste in the selected ULBs are given in **Table 4.6**.

Table 4.6: Details of utilisation of municipal waste in the selected ULBs

S.N.	Name of ULB	Procedure of waste to wealth	Wealth Generation	Remarks
1	Indore	PPP mode	₹ 3.5 crore per year	Processing of municipal waste is being done by the private vendors by setting up plants for processing the waste. Municipal waste is being collected by the ULB and sent to the plant for processing. Vendors are paying a lump sum amount yearly.
2	Ujjain	PPP mode	NIL	Processing of municipal waste is being done by the private vendors

S.N.	Name of ULB	Procedure of waste to wealth	Wealth Generation	Remarks
				by setting up plants from JnNURM grant. Municipal waste is being collected by the ULB and sent to the plant for processing. ULB is paying processing charge of ₹ 201.01/MT. Wealth generated from the processing is being kept by the Vendor.
3	Dewas	PPP mode	₹ 5.03 lakh per year	According to agreement (November 2018), vender will pay royalty ₹ 5.03 lakh per year which will enhance 5 *per cent* yearly. Wealth generated from the waste will be under the ownership of vendor.
4	Alot	ULB level	NIL	No wealth generated as compost pit has not been set up.
5	Mahidpur	ULB level	NIL	Temporary compost pit was procured in December 2021.
6	Sanwer	ULB level	NIL	Compost generated is being used by the ULB itself.

(Source: Selected ULBs)

Audit analysed the procedure of waste to wealth generation in selected ULBs and observed that four ULBs, Mahidpur, Sanwer, Alot and Ujjain have not been able to implement the objectives of the Swachh Bharat Mission in order to generate wealth from waste.

***Conclusion**: The Minor Hypothesis was tested and found to be true. Solid wastes were found to be discharged through drains in all the selected ULBs, 'Waste to Wealth' is not being implemented across the ULBs (barring ULBs, Indore and Dewas).*

4.4 Minor Hypothesis No-14: Inadequate management of Ghat cleaning and cremation activities by ULBs.

4.4.1 Non-preparation of plan and guidelines for Ghat cleaning

There were no guidelines for cleaning of Ghats of Kshipra River, in absence of which there was improper management of cleaning and disposal of solid waste.

There are 13 Ghats on Kshipra River within the boundaries of ULBs, out of which eight Ghats are in Ujjain and five Ghats are in Mahidpur as detailed in **Table 4.7**

Table 4.7: Details of Ghats physically verified

S. N.	Name of ULBs	Name of Ghats along Kshipra River	Name of Ghats where Physical verification was carried out
1	Ujjain	Gaughat, Mangalnath, Siddhwat, Triveni, Ramghat, Chakratirth, Chintaman and Dutta Akhada ghat	Gaughat, Mangalnath Ghat, Siddhawat Ghat
2	Mahidpur	Gangawadi Ghat, Gaughat, Nav Ghat, Kila Ghat, Rawla Ghat	Gaughat

(Source: Selected ULBs)

Audit observed that there was no specific cleaning programme of Ghats alongside the Kshipra River and there was also no provision of funds for the same.

During physical visit of four Ghats at Kshipra River in these ULBs, Audit observed that these four Ghats were not cleaned properly, and the waste was eventually getting into the Kshipra River.

Images 4.26 and 4.27: Photographs captured at Ramghat, Ujjain

Image showing leftover cloths on Ramghat of Kshipra River.

Image showing used flowers and other material deposited at Ramghat in Kshipra River.

Image 4.28: Photograph captured at Jabsingpura, Gaughat, Ujjain

Image showing used flowers and other material deposited in Kshipra River.

Image 4.29: Photographs captured at Mangalnath Ghat, Ujjain

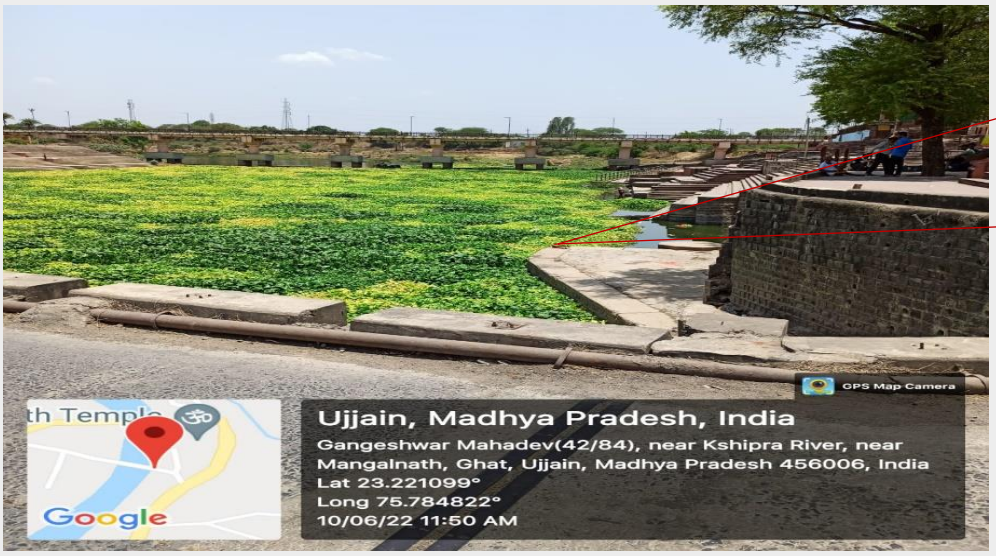


Image showing Algae at Mangalnath ghat due to lack of cleaning, which may have negative impact on river ecosystem.

Image 4.30: Photograph captured at Siddhawat Ghat, Ujjain (P-3)

Image showing used flowers and other deposited material in Kshipra River.

Image 4.31: Photographs captured at Gaughat, Mahidpur

Image showing plastic and solid waste at bank of Kshipra River.

The UDHD replied (January 2023) that in case of ULB, Ujjain, daily ghat cleaning work is ensured by ULB with the help of 50 workers.

Reply is not acceptable as no documentary evidence and time schedule of the same were provided and the waste lying on the ghats can also be seen from the **Images 4.26-4.31** as well.

The CMO, Mahidpur stated (March 2022) that cleaning is being done on the rotation basis. Cleaning of these spaces will be further done and intimated to Audit.

However, the work done is evidently not effective and the management of solid waste was poor despite incurring expenditure on the activity.

4.4.2 Preventive measures were not made to minimize the impact of festivals on river.

No guidelines for minimizing the impact of festivals on the river were found in any of the selected ULBs.

As per 'General Guidelines for Idol Immersion' issued by CPCB, Local Bodies/Urban Bodies/District Authorities should make efforts to minimise impact of festival and idol immersion in the river. For this purpose, identification and arrangement of adequate number of designated temporary or artificial immersion ponds or tanks in consultation with River/Pond Authority, Irrigation Department, and other concerned State/UT Departments, should be done.

Devotees come to Ujjain to take holy dip in Kshipra River throughout the year on the occasion of various religious festivals. People also visit Ujjain from different places of the country for other religious activities such as last rites and during this period, flowers and other ritualistic materials are immersed in the Kshipra River. Further, during the festivals, idols are commonly immersed in the Kshipra River as shown in **Image 4.32**.

Image 4.32: Image showing immersing the Idol in the Kshipra

Image showing immersing of the Idol in the Kshipra River.

In these contexts, Audit observed the following:

- **Guidelines to minimise the impact of festivals on the River**

Audit observed during test check in two ULBs (Ujjain and Mahidpur), through which the Kshipra River flows, that preventive measures for minimising impact of festivals on the river

were not taken adequately and guidelines for idol immersion and *pind daan*/flowers/offerings in the river were also not issued by ULBs. Further, pre and post analysis of impact of idol immersion in the water of Kshipra and Kahn rivers was also not done by the concerned ROs of MPPCB.

➢ Non construction of Nirmalya Pit on Kshipra River

As per Action Plan of Kshipra River, storage/cleaning pits[10] from *Narsingh Ghat* to *Choti rapat* of *Ramghat* in Ujjain were proposed, wherein concrete and tiles fixing in the bed of Kshipra River along with treatment of waste water through rapid sand filter was to be done followed by chlorination/ ozonisation. Tentative first stage estimate was of ₹ 40 crore. The detailed proposal was to be prepared in three months by the ULB, Ujjain and after sanction from competent authority, plan was to be executed in two years.

Audit observed that no such construction of cleaning/storage pit and tiling works in Kshipra River was done by ULB, Ujjain. Due to non-construction of pits and tiling work for the wastewater treatment in the River, the Ghats of Kshipra River remained dirty and polluted.

The UDHD replied (January 2023) that in case of ULB, Ujjain during festival, ULB arranged adequate number of designed temporary or artificial ponds on the occasion of *Ganesh Chaturthi* and *Durgapooja* and *Nirmalaya pit* were constructed and tiling work was also done by ULB.

Reply is not acceptable as no documentary evidence is provided of pit or tiling work done by ULB to keep the river clean during festival season. Further, during Joint Physical Verification, no such work was found executed.

4.4.3 Regulations on cremation activities were not appropriate at the Riverbanks

Guidelines for regulation of crematoriums at the banks of Kshipra and Kahn Rivers did not exist except in one ULB.

Eight[11] crematoriums were located at the banks of Kshipra and Kahn Rivers in ULBs, Mahidpur, Sanwer and Ujjain. The concerned ULBs had not issued any guidelines to regulate the cremation activities at banks to keep the river clean.

During test check of crematoriums at Sanwer and Ramghat at Ujjain, Audit observed that the crematorium at Sanwer was well managed but Ramghat crematorium, located on the side of Kshipra River, was not being managed properly. There was a small pond for disposal of remains, which itself was dirty. There was no regulation by ULB, Ujjain to prevent impact of cremation activities on Kshipra River. Images of crematorium and mud filled immersion pond at Ujjain are shown below:

[10] A concrete pond of 200m x 30m in size was to be constructed at the bank of River for flowing of flowers, rice and wheat under the *asthi visarjan*, *Pind dan*, *etc*.

[11] At Chakratirth (near Ramghat), Okhleshwar, Vikrant Bhairav, Moti Nagar and Shani Mandir in Ujjain; Shailini Satya Samshan Ghat and Shanti van in Mahidpur; and crematorium at Sanwer.

Images 4.33 and 4.34: Crematorium and dirt filled immersion pond at Ujjain

Image showing dirt filled immersion pond at Ujjain.

Image showing crematorium at Kshipra River, Ujjain.

Conclusion: *The Minor Hypothesis was tested and found to be true. There were no guidelines for cleaning the Ghats of Kshipra River for minimizing the impact of festivals on the river and for regulation of crematoriums on the banks of Rivers in the ULBs.*

4.5 Recommendations

Audit recommends that:

- ULBs may formulate the guidelines for regulation in the FPZ and River Front Development and may address the issue of removal of encroachments from the FPZ and may formulate guidelines for cleaning of Ghats of Kshipra River and regulation of crematoriums on the banks of Rivers.
- ULBs and Forest Department may develop an effective mechanism for plantations alongside of Kshipra River.
- ULBs may ensure the compliance of Solid Waste Management Policy and 'Waste to Wealth Mission' may be implemented.
- ULBs may prepare guidelines and ensure its strict implementation for minimizing the impact of festivals on the river.

CHAPTER 5

WATER FLOW IN RIVER

5
CHAPTER

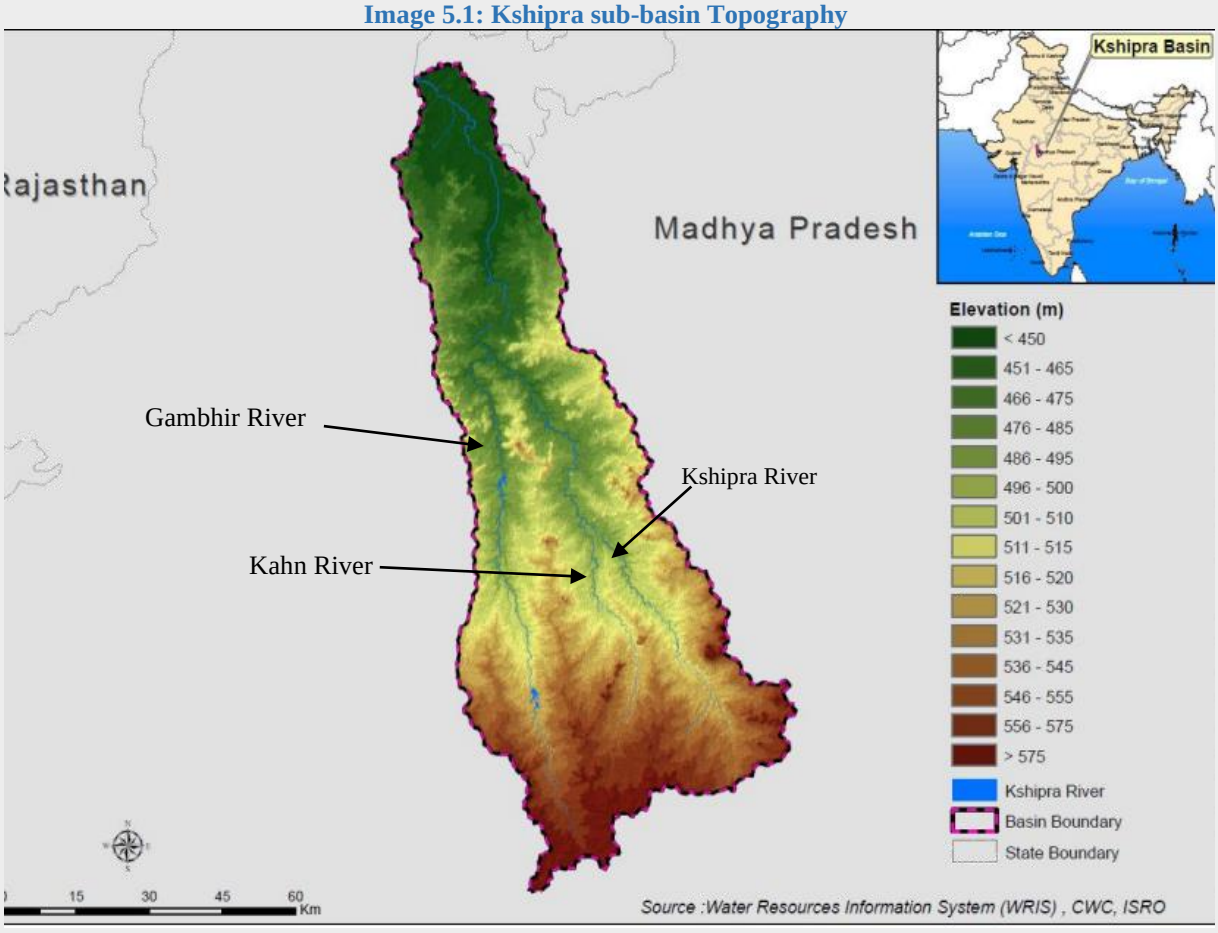
Water Flow in River

Sub-Major Hypothesis No-4: Water flow in Kshipra River has reduced drastically.

5.1 Introduction

Three important cities of Malwa region of Madhya Pradesh, namely Dewas, Indore, and Ujjain are located in Kshipra watershed. The main tributaries of Kshipra include the Kahn River and the Gambhir River. The main course of the Kshipra lies over the grassy plains of Malwa between low banks and from Mahidpur onwards it is characterised by high rocky banks. The water of the Kshipra River is used for drinking, industrial and lift irrigation purposes. However, the main land use along the river is agriculture. The basin location and key topographic and drainage details are shown in **Image 5.1.**

Image 5.1: Kshipra sub-basin Topography



(Source: CWC Kshipra sub-basin Report)

As per Central Water Commission (CWC) sub-basin report on Kshipra River (2011), the drainage pattern in the area is predominantly of dendritic type[1]. The northern part is drained by several northerly flowing rivers like Kshipra, Gambhir and Chambal. Kahn and Gambhir are main tributaries of Kshipra River which ultimately merge into Chambal River.

➢ Land Use of Kshipra Basin

As per information provided by CGWB, Bhopal, land use in the watershed of Kshipra River catchments is tabulated in **Table 5.1.**

Table: 5.1 Land use in Kshipra Watershed

S. N.	Land use	Area in Hectares	Percentage with respect to watershed area
1	Geographical Area of Kshipra watershed	5,77,700	--
2	Forest Area	91,648	15.86
3	Non-cultivable Land excludes fallow land (Pastureland Garden, *etc*.)	94,927	16.43
4	Land not available for agriculture	49,970	8.65
5	Cultivable Land	14,977	2.59
6	Fallow Land	5,133	0.89
Net Sown Area {1-(2+3+4+5+6)}		**3,21,045**	**55.58**

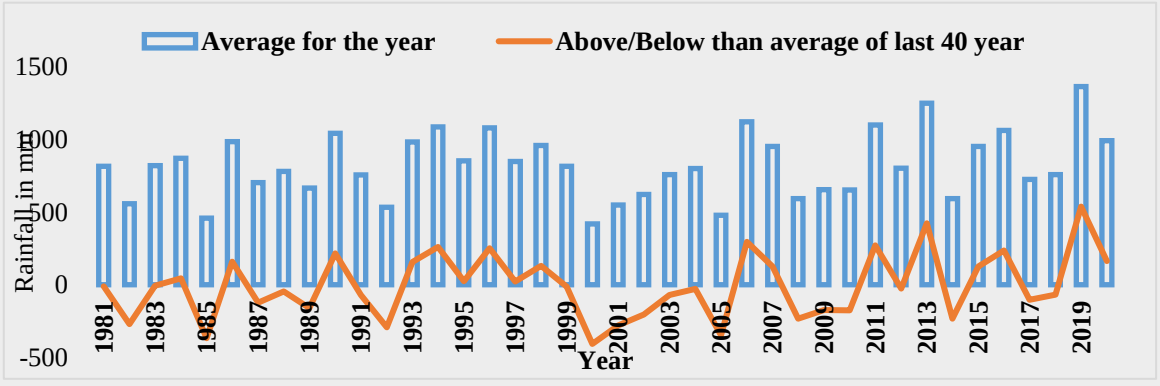
(Source: Information provided by CGWB)

From the above table, it could be seen that forest cover in the Kshipra Water shed is about 15.86 *per cent*, whereas overall forest coverage in Madhya Pradesh is 25.14 *per cent* as per report of Forest Survey of India. As forest play vital role in water and soil conservation, comparatively less forest coverage can result into less moisture retention impacting the water table of the basin as well.

➢ Precipitation in the Kshipra Basin

The variation in annual rainfall data of 12 stations situated in Kshipra sub-basin, for the period 1981 to 2020 was obtained from MPWRD. The average rainfall for these years was 827.33 mm. Annual rainfall and its deviation from the average rainfall for the 40 years is depicted through **Chart 5.1.**

Chart 5.1: Average Rainfall (mm) and variation in rainfall (mm) in Kshipra sub-basin



(Source: Data received from the Water Resources Department, GoMP)

[1] A drainage pattern that may develop on homogeneous rock, which has a shape resembling the pattern made by the branches of a tree or the veins of a leaf.

As per the **Chart 5.1**, the annual rainfall in 23 years was below than the average rainfall of the aforesaid 40 years.

➢ Flow in Kshipra River

For the purpose of analysis of flow in Kshipra River, CWC data on water flow at Mahidpur and Ujjain monitoring stations for the varying periods between 1981-82 and 2020-21 was considered. From the data, it was observed that discharge of water in the Kshipra River was comparatively in better condition in the year 1990, which had reduced in the year 2001. Further, the data for the years 2010-11 to 2021-22 revealed that the River flow turned almost dry during pre and post-monsoon seasons. This was also observed during sampling process of water analysis of the Kshipra River along with ULBs and MPPCB's personnel and IIT Indore's team in March 2022.

Further, Kshipra Sub-Basin Report, 2011 by CWC also ascertains that the Kshipra River was perennial up to 1980 and the River gradually started turning dry during the non-monsoon seasons.

Over the years, the river has lost its perennial nature and now runs dry for a period of five to six months per year. The main land use along the river is agriculture.

After 2011, Narmada-Kshipra Simhasth Link (NKSL) had started functioning in 2014, through which inter basin water transfer is being done by constructing a barrage in the Kshipra River at Dewas. But in spite of NKSL Project and comparatively better monsoon, water flow in Kshipra River had declined in 2020. Reasons for decline in water flow are being discussed in paras below-

Audit findings have been discussed in in the following paragraphs:

5.2 Minor Hypothesis No-15: There was inadequate provision for storage of rainwater to maintain environmental flow.

Rainwater Runoff- According to CGWB, Malwa plateau area is an acute water scarce region. About 70 *per cent* of the rainfall is received during the monsoon period and major part of rainfall is lost as runoff (**Image 5.2**). Storing of runoff water in tanks, minor dams, check dams or stop dams, can help in rejuvenating the Kshipra River.

Image 5.2: Images of rainfall/surface runoff

Farmland runoff

Urban runoff flowing into a storm drain

After a heavy rainfall, sheets of water running downhill may be seen

According to information provided by CGWB (December 2021), available surface runoff and utilized runoff in Kshipra sub-basin are approximately estimated to be 1,075 MCM and 385.2 MCM respectively, based on the data of rainfall and considering 29 *per cent* co-efficient of rainfall. It is estimated that about 192.6 MCM water is being utilized by structures like percolation tanks, check dams, nala bunds, stop dams, barrages, *etc*., constructed under various programmes. Thus, there will be balance runoff of about 497.2 MCM water that can be utilized for further water augmentation in the area.

Environmental flow - Environmental flow describe the quantity, timing, and quality of water flow required to sustain freshwater and estuarine ecosystems by creating pools of water.

According to the study of India Water Week, National Mission for Clean Ganga, Continuous Stream Storages (CSS) filled with minimum environmental flows is easily implementable approach for stream rejuvenation. Rivers with upstream storages can be rejuvenated without much impact on the other water demands and up-stream storages need to release environmental flows.

Further, CWC guidelines for maintaining longitudinal connectivity through dams also stated that ecological/environmental flows are required to be maintained through a river reach for sustaining its ecosystem and dependent species. It means enough water is to be released in the downstream of the river system after utilizing the water for the development projects in order to ensure downstream environmental, social and economic benefits.

The hypothesis was checked from the data at NVDA and at ULBs through various aspects, *i.e*., provision to prevent rainwater runoff and whether continuous stream storage with environmental flows was implemented for stream rejuvenation of river.

Findings on above hypothesis are discussed in detail as below:

5.2.1 Non-implementation of continuous stream storage with environmental flows for stream rejuvenation

Provision of environmental flow in Kshipra River is not being ensured during lean season.

According to the NGT's order[2], minimum environmental flow of the rivers may be ensured. NGT also instructed to provide a special focus in Action Plan for maintaining the

[2] *Suo-moto* judgement passed by NGT on the basis of reporting by newspaper (case no 673/2018).

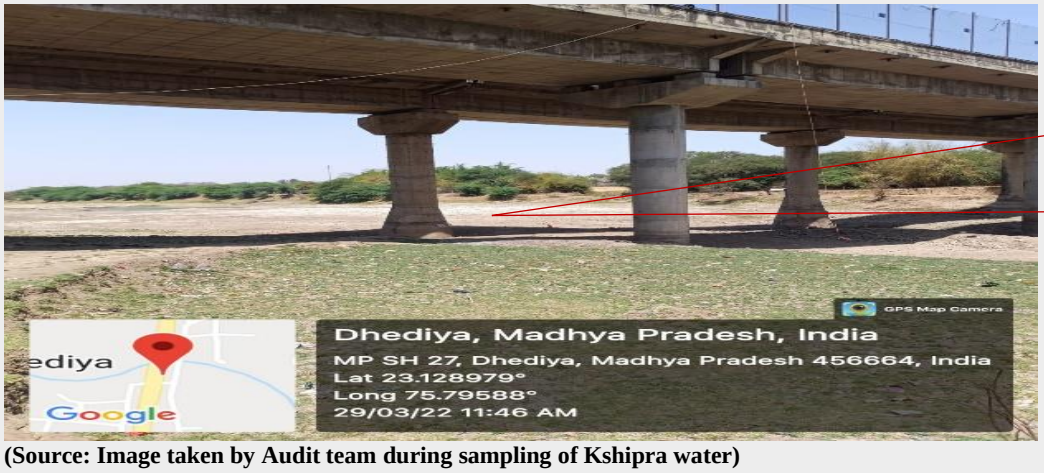
environmental flow. As per NGT's direction (September 2018), minimum 15-20 *per cent* of average lean season flow should be maintained in the river for environmental flow.

As per the Kshipra Action Plan, prepared by the MPPCB, the flow in Kshipra River is normally 10 Cu. M. per second. However, the discharge is taking place in the Kshipra River during rainy season and the period when the Kshipra Barrage (Dewas) overflows. However, when the flow stops during pre and post-monsoon seasons from the barrage, the Kshipra River becomes almost dry. Though, as per Action Plan, measurement of e-flow of the Kshipra River was to be done by the WRD within three months and accordingly in its compliance report, WRD had stated that flow in River is being maintained through Narmada Kshipra Link. However, Audit observed that NKSL has completely failed to maintain environmental flow in Kshipra River as detailed below.

In the lean period, only available source of water in Kshipra River is through the NKSL. However, only 97.72 MCM water was released from Kshipra Barrage through NKSL in lean seasons between February 2014 and January 2019, which was insufficient to ensure environmental flow of River Kshipra and to make it a perennial river.

Images 5.3 and 5.4: Showing dry Kshipra River in Marethi and Dhediya

Kshipra River having water in patches at Marethi.



Kshipra River completely dry at Dhediya below Indore bridge.

(Source: Image taken by Audit team during sampling of Kshipra water)

Further, during sampling process for water analysis of Kshipra River, along with ULBs and MPPCB's personnel and IIT Indore's team in March 2022, it was also observed that River was almost dry, and water was found in few patches only as could be seen from the **Images 5.3 and 5.4.**

Moreover, longitudinal connectivity through dam was not maintained by utilization of huge rain water runoff (497.2 MCM), as mentioned in **Paragraph 5.2.**

The NVDA accepted the facts of release of only 97.72 MCM water and replied (December 2022) that the issue of implementation of continuous stream storage with environmental flows for system rejuvenation pertains to Water Resources Department.

The reply is factually incorrect as NKSL was constructed with the objective to increase flow in the river and ensure availability of water at Ghats of Ujjain and make Kshipra a perennial river. Thus, the reply is indicative of the fact that NVDA did not endeavour to ensure maintenance of environmental flow in Kshipra River and to make it a perennial river.

Conclusion: *The Hypothesis was checked and found to be true. It was observed that provision for providing water in lean season into Kshipra River was made but not implemented. Thus, environmental flow in lean season could not be achieved as sufficient quantity of water was not released.*

5.3 Minor Hypothesis No-16: Inadequate plantation at Riverbanks had led to less retention of water.

As per River Rejuvenation Report of CGWB, planting trees to increase vegetation cover along Kshipra River is a long-term but permanent solution for restoring the eco-system of the river. Further, Action Plan for Rejuvenation of Kshipra River by MPPCB also emphasises on plantation for continuous flow of the river and to prevent soil erosion along the river.

The hypothesis was checked from the data of ULBs, Forests and PRIs, *i.e.*, whether enough plantation of water retention plants to stop rainwater runoff and required soil conservation works were executed. Observations are discussed below:

5.3.1 Inadequate plantations in Kshipra sub-basin

Despite having comparatively less forest cover in Kshipra sub-basin, efforts for adequate planation were not being made by Forest Department and PRIs.

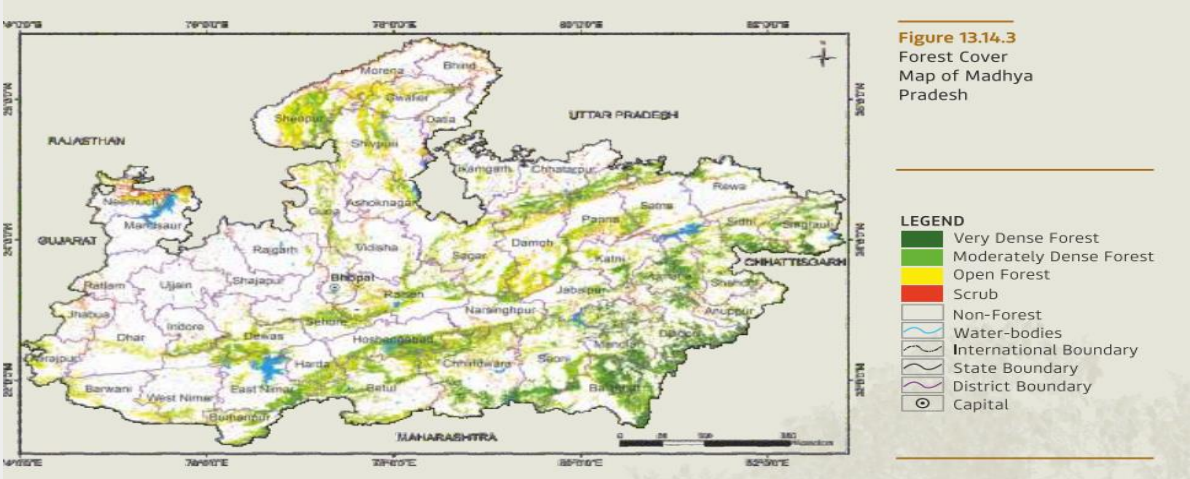
As per NGT's orders (September 2018), an Action Plan for restoration of water quality of river was to be prepared. The Action Plan was supposed to address issues relating to management of FPZ and plantation on both sides of the river. Setting up of biodiversity parks on flood plains by removing encroachment shall also be considered as an important component for river rejuvenation.

Due to deforestation in catchment area of Kshipra River, there is heavy flow of water during monsoon and drought like conditions after monsoon. This leads to soil erosion at riverbanks and in riparian areas. To stop this loss, plantations and soil conservation works have been prescribed in the Working Plans of Forest Divisions.

Additionally, plantation activities in Kshipra and Kahn riverbanks in urban areas have also been undertaken at ULB Level ***(Refer paragraph 4.2.4 ante).***

Forest cover in districts of Madhya Pradesh as per Indian State of Forest Report, 2021 is given in the **Image 5.5.**

Image 5.5: Forest cover in districts of Madhya Pradesh



(Source: Indian State of Forest Report, 2021)

As per report, percentage of Geographical Area covered by forest in Kshipra sub-basin is given in **Table 5.2**.

Table 5.2: Geographical Forest Area of districts in Kshipra sub-basin

(Area in Sq. km)

S.N.	Name of District	Forest area in Percentage to total geographical area in (2021)	Change w.r.t. to 2019 Assessment (-) Decrease (+) Increase (in *per cent*)
1	Indore	17.31	(-) 4.12
2	Ujjain	0.60	0.48
3	Dewas	27.74	(-) 8.60
4	Madhya Pradesh	25.14	10.11

(Source: Indian State of Forest Report, 2021)

From the **Table 5.2**, it is clear that forest coverage in Ujjain and Indore is much below the State's forest coverage. In Dewas, the forest cover was above the State's forest coverage percentage, but it has reduced by 8.60 *per cent* between 2019 and 2021. Further observations on plantations alongside Kshipra River are discussed below:

➢ Plantation by Forest Department

As per information provided by DFOs, Indore and Ujjain, plantation in 46.63 ha and 206 ha area along Kshipra/ Kahn River was done by the Ujjain and Indore Forest Divisions respectively. However, no such activity was taken up by the Dewas Forest Divisions.

Analysis of Google Earth imagery for plantations done at Ujjain revealed that there was no change in vegetation in plantation area during 2016 to 2021. Moreover, plantation done by Indore Forest Division was not at riverbank, which could have prevented soil erosion from the riverbank.

GoMP, Forest Department stated (December 2022) that plantation along Kshipra and Kahn Rivers was executed by respective Forest Divisions, Ujjain and Indore. Deforestation due to Kali-Sindh Scheme is one of the causes of decreasing forest cover. Moreover, future Working

Plan of Divisions will include plantation and soil conservation work for rejuvenation of Kshipra River.

However, no documentary evidence was provided in support of the claim about the plantations done by the Forest Divisions.

➢ Plantation by the PRIs

According to the Para 7.6 of the Annual Master Circular 2019-20, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), 2005, afforestation including Assisted Natural Regeneration (with integrated soil & moisture conservation works), tree plantation and horticulture activities can be taken up under MGNREGA on common, forest and private, *viz*. degraded forest lands, waste lands, public and community lands, pasture lands, along riverside, canals and embankments, *etc*.

There are 212 villages under the 140 Gram Panchayats situated along the Kshipra and Kahn Rivers in four districts of the Kshipra sub-basin. Districts wise details of plantations are given in **Table 5.3**.

Table 5.3: Details of Plantation by the PRIs

S.N.	District Name	No. of Villages			Total No. of plants planted	Area of Plantation (ha)
		Total	Plantation was done	Plantation was not done		
1	Indore	63	53	10	29,854	244.78
2	Ujjain	102	71	31	24,280	60.60
3	Ratlam	16	16	0	3,473	3.2
4	Dewas	31	31	0	5,941	7.35
Total		**212**	**171**	**41**	**63,548**	**315.93**

(Source: Commissioner, Mahatma Gandhi National Rural Employment Guarantee Scheme, Madhya Pradesh)

From the **Table 5.3**, it could be observed that plantations in 315.93 ha was done by the PRIs in the Kshipra sub-basin during 2016-21. There was no plantation by 41 villages of Indore and Ujjain districts. Gram Panchayats of Sanwer (Indore) Janpad Panchayats had not participated actively. Further, actual plantation status was physically verified by Audit with the officials of PRIs in sampled 28 villages. Results of the joint physical verification are given in **Table 5.4.**

Table 5.4: Reported plantation and actual plantation at sampled village

S.N.	District	Tehsil	Total no. of villages sampled	No. of Plants planted as per information	No. of plants found in physical verification	Survival Rate
1	Dewas	Dewas	6	2,600	1,850	71.15
2	Ujjain	Mahidpur	5	2,000	1,030	51.50
3		Ujjain	3	600	340	56.67
4		Ghatiya	5	4,100	585	14.27
5	Indore	Sanwer	7	8,355	7,316	87.56
6		Indore	2	8,900	4,652	52.27
Total			**28**	**26,555**	**15,773**	**59.40**

(Source: Joint physical verification of Gram Panchayats)

From the **Table 5.4**, it can be observed that actual available plantation was much below than the information provided by PRIs. Survival rate of plantation was 59.4 *per cent* in test

checked sampled villages. However, in the villages of Ghatiya Janpad Panchayat, only 585 plants were actually available as against 4,100 plants (indicating survival rate of 14.27 *per cent*) which is very low.

Thus, lack of proper maintenance of plantations will further lead to soil erosion alongside river and long term envisaged objective of rejuvenation of river through plantations and soil moisture conservation works will not be achieved.

➢ Plantation by ULBs

Out of selected six ULBs, Kshipra and Kahn rivers pass through ULBs, Indore, Ujjain, Sanwer and Mahidpur. In ULBs, Indore and Ujjain, plantations in the riverbanks were carried out, which has been discussed in **Paragraph 4.2.4**. In ULBs, Sanwer and Mahidpur, plantation work was not executed in Kshipra and Kahn Riverbanks.

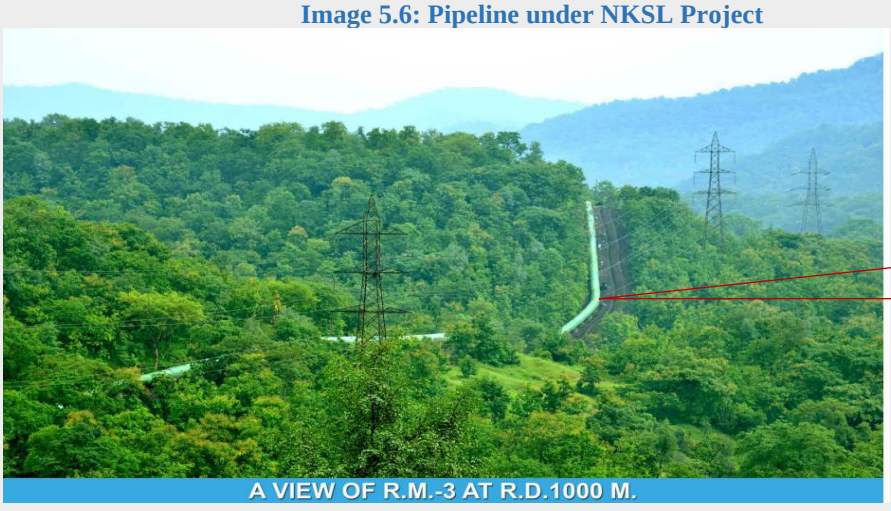
Conclusion- *Hypothesis is mostly true. It was observed that efforts for plantation were being carried out mostly at ULBs level, but Forest Department and Gram Panchayats of Ghatiya Janpad Panchayat in Ujjain had not shown active participation.*

5.4 Minor Hypothesis No-17: Inadequate accounting and management of water of Narmada- Kshipra Simhasth Link Project by NVDA.

The Government conceived NKSL Project (₹ 432.00 crore) to deliver five cumecs of Narmada water into Kshipra River in order to make it perennial. It was projected as a first ever river linking project of India by the GoMP. The project was started on November 2012 and was completed in February 2014.

Under NKSL Project, five cumecs water was proposed to be lifted from Sisliya tank[3] and released in Kshipra River at Ujjeni village.

Image 5.6: Pipeline under NKSL Project



View of NKSL pipeline.

(Image Source: NVDA)

[3] Narmada water from Omkareshwar Project is stored in Sislia tank for further distribution among Omkareshwar canal, NKSL and other Projects. Sislia tank is also acting as balancing reservoir.

The hypothesis was checked for the impact of NKSL and Ujjeni to Ujjain Pipeline (UUPL) (***refer Images 5.7 and 5.8)*** through the data of NVDA and ULBs with various aspects such as execution of agreement between NVDA and ULBs/Industries for water drawl from NKSL, installation of flow meters at the intake points of NKSL, adequate release of water as per natural flow of Kshipra River and recovery of dues for proper Operation and Maintenance of NKSL Project.

Findings on the hypothesis are discussed in detail below:

5.4.1 Inadequate release of water to maintain natural flow of Kshipra River

Water availability was not ensured in the Kshipra River, during lean season, though the NKSL Project was constructed to increase flow and ensure availability of water at Ghats of Ujjain by making Kshipra a perennial river.

As per DPR of NKSL, five Cumecs water was to be released in Kshipra River to increase flow and ensure availability of water at Ghats of Ujjain and make Kshipra a perennial river. For this purpose, Kshipra Barrage (Storage capacity of nine MCM) at Dewas works as balancing reservoir[4]. Through this barrage, water was to be released in Kshipra River.

However, another 78 km long Ujjeni-Ujjain Buried Pipeline (UUPL) Project costing ₹ 157.49 crore was introduced in 2019 to cater water directly into Triveni Barrage of Kshipra at Ujjain. The Project was commissioned in November 2020 and instead of the Kshipra Barrage, Dewas, water is being discharge directly further down at Triveni Barrage, Ujjain. Flow charts of NKSL and UUPL are given in **Images 5.7 and 5.8**.

[4] A reservoir constructed in the downstream for holding water as storage and hydraulic control.

Images 5.7 and 5.8: Flow Charts of NKSL and UUPL

Construction of NKSL in 2014

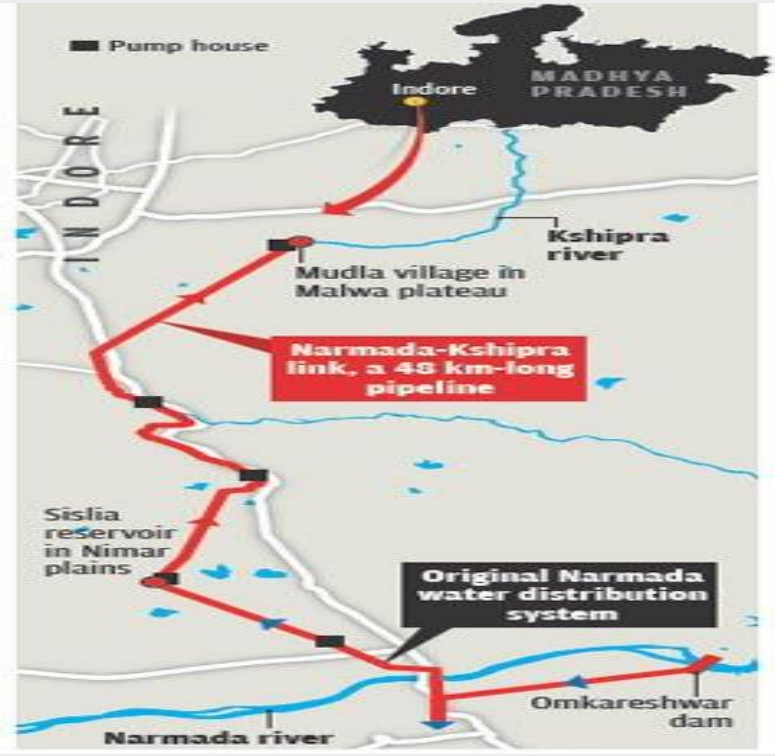
- **Objective-**Make Kshipra River perennial and ensure water availibility in the Ghats during Simahasth.
- **Actual Status-**Water was Supplied from Narmada River to Kshipra River at Ujjeni for only 37 times between 2014 and 2019. Only 97.2 MCM water was released during the period which was insufficient to make the River Perennial.

Why requirment of UUPL was felt?

- Significant Leakage of water from Kshipra River between Dewas to Ujjain.
- High cost of water transfer from Narmada River to Kshipra River.

Construction of UUPL in 2019

- **Objective-** Ensure water availability at Ghats at Ujjain during festivals.
- **Actual Status-** Water of Narmada River was directly supplied to Ujjain from Ujjeni through under ground pipeline.
- **Impact-** Objective of NKSL could partially be achieved as there was minimal water supply in Kshipra River between Dewas to Ujjain in lean season through NKSL. Hence, this stretch became dry after construction of UUPL.



From Narmada, water is stored in Omkareshwar dam and from there, water is transferred to Sislia reservoir through Omkareshwar canal. NKSL connect Sislia with Mundla village and covers a distance of 48 km and links with Kshipra at Ujjeni near Mundla.

(Source: NVDA)

➢ Release of water in Kshipra River before construction of UUPL up to 2019[5]

When water is released from NKSL at Ujjeni village, it reaches up to Ujjain through Dewas and other villages on the way. However, on the requisition of Collector, Ujjain, NVDA releases water from NKSL during the major festivals at Ujjain.

Details of water released from Kshipra Barrage are given in **Table 5.5**.

Table 5.5: Release of water from Kshipra Barrage

(Water quantity in MCM)

S.N.	Year	Oct-Jan (Non-Monsoon)			Feb-May (Lean Season)		
		Total no. of days	No of Days on which water was discharged	Quantity discharged	Total no of days	No of Days on which water was discharged	Quantity discharged
1	2015-16	123	2	4.5	120	13	24.9
2	2016-17	123	2	2	120	4	8
3	2017-18	123	4	12.5	120	5	21.3
4	2018-19	123	4	10	120	00	00

(Source: Information provided by the NVDA)

From the **Table 5.5**, it could be seen that during lean season, water availability was not ensured in the Kshipra River as water is released from Kshipra Barrage (Dewas) only when the requirement is placed by Collector, Ujjain during festivals.

Therefore, NVDA had deviated from its focus of making Kshipra River perennial. Instead, it has diverted its focus to ensure availability of water at Ghats of Ujjain during Simhasth and any other major festivals. Hence, water availability at Kshipra could not be ensured in the lean season (January to May). In such a situation, there is not enough water in Kshipra to ensure that it becomes perennial.

➢ Release of water in Kshipra River after commissioning of UUPL (Scenario after 2019)

As per the DPR of UUPL, due to open flow of water in Kshipra River, farmers used to take water for irrigation by pumping. Thus, UUPL was constructed to inject 2.2 Cumecs of Narmada water directly at Triveni Barrage (Ujjain) and it had started functioning from November 2020.

Audit observed that after construction of UUPL, water was being directly released into Triveni Barrage at Ujjain through buried pipeline for use in Ghats and remaining portion of the Kshipra River between Kshipra Barrage (Dewas) and Triveni Barrage (Ujjain) remained almost dry or with very less water in the patches in post-monsoon season. No water was being discharged into Kshipra River in lean period from Kshipra Barrage, Dewas. Impact of commissioning of UUPL on Kshipra River between Dewas and Triveni Barrage (Ujjain) is shown in **Image 5.9**:

[5] Scenario after 2019 is discussed in next paragraph.

Image 5.9: Showing impact of UUPL on Kshipra River

(Image Source: Water availability assessment, a study report by the Maulana Azad National Institute of Technology, Bhopal)

Therefore, the NKSL project was not fulfilling the purpose of making Kshipra a perennial river as also evident from the **Images 5.3 and 5.4**.

➢ Kshipra River remains seasonal despite huge expenditure

As per information provided by NVDA, huge expenditure had been incurred to ensure availability of water in Kshipra River. Details of expenditure made by NVDA since 2014 are detailed below-

Table 5.6: Details of expenditure incurred by NVDA

S.N.	Description of Expenditure	Amount (₹ in Crore)
1	NKSL Project Cost	432.00
2	UUPL Project Cost	157.49
3	Expenditure on power charges for NKSL from 01/2014 to 06/2022	303.82
4	Expenditure on O&M (NKSL)	17.92
Total		**911.23**

(Source: NVDA)

From the **Table 5.6**, it could be seen that even after spending ₹ 911.23 crore, condition of Kshipra River had not improved and it continues to remain dry in lean season. Water availability was ensured only at different Ghats of Ujjain and NVDA failed to make river perennial through the first ever river linking project in the country.

The NVDA accepted the facts and replied (December 2022) that it had become necessary to stop open flow of water in Kshipra River to prevent losses due to open flow and prevent theft of water by farmers for irrigation. Now, water is being released from UUPL directly to Kshipra Barrage and Triveni ghat Ujjain as per demand of ULB/ District Administration.

The fact remains that Kshipra River continues to remain non-perennial even after incurring huge expenditure and being lauded as first ever river linking project in the country by the GoMP. NVDA and GoMP should have considered other end users of water, such as agriculture while planning for the NKSL.

5.4.2 Irregular water drawl from NKSL and Kshipra River without agreement

ULBs were drawing water from NKSL and Kshipra River without agreement with NVDA and WRD. This had led to improper management of River water.

As per Madhya Pradesh Irrigation Rule, 1974, water may be supplied for any village tank, town or for industrial purposes and to a Corporation at the rates specified in the Act. For this purpose, a formal agreement should be made between water supplier and water user. Lump sum quantity of water drawl by consumers is mentioned in the agreement and this leads to controlled use of river water by Consumers. Further, there should be a provision of flow meters at intake point where water is being provided to Industries and local bodies. Scrutiny of records revealed improper management of river water as detailed below:

➢ Water supply from NKSL without agreement with NVDA

Nodal authority for providing water through NKSL is Executive Engineer, NVDA Division No. 32, Barwaha. Audit, however, observed that water through NKSL is provided to ULB, Dewas and ULB, Ujjain without any agreement, which is mandatory as per Madhya Pradesh Irrigation Rule. Audit observed following impacts due to non-execution of Agreements:

1. There is discrepancy of data between NVDA and ULB, Dewas regarding quantity of water. As per NVDA, ULB, Dewas had taken 142.75 MCM[6] of water from February 2014 to January 2019, while ULB, Dewas stated (September 2021) that 13.38 MCM of water is taken by ULB, Dewas from NKSL, during the aforesaid period.
2. Similarly, ULB, Ujjain denied for any responsibility of payment for quantity of water received from NKSL while NVDA claimed to have supplied 140.07 MCM of water in Kshipra River.
3. Both ULBs had not agreed for supply rate of water, provided to them through NKSL, which was decided at ₹ 22.60/ Cu. M. by NVDA.
4. There was non recovery of Water Charges amounting to ₹ 786.07 crore from ULBs, Dewas and Ujjain, which was required to be utilized in the payment of O&M charges and electricity dues of NKSL.

[6] MCM can be obtained after dividing by 10,00,000 to the Cubic metre (Cu. M.).

5. Further, flow meters were also not installed which is an important condition of agreement and are also necessary to measure the flow. Thus, actual supply of water to ULBs could not be ascertained by the NVDA.

The NVDA replied (December 2022) that agreements for supply of water through NKSL have been drawn among NVDA and DMIC Pithampur, VUPL Ujjain, Dewas Water works, and IIT Simrol. Water accounting problem has been resolved after commissioning of UUPL with flow meter. However, continuous efforts are being made to execute agreements with ULBs, Dewas and Ujjain to recover outstanding dues.

The reply of NVDA is irrelevant in terms of Audit Observation as no agreement for supply of water with ULBs, Dewas and Ujjain had been drawn.

➢ Water drawn from Kshipra River without agreement with WRD

Three[7] ULBs are extracting water from Kshipra River for drinking purpose. These ULBs withdraw 36.2 MLD of water from Kshipra River as detailed in **Table 5.7.**

Table 5.7: Details of execution of agreement for water drawl with WRD and consumers

S.N.	Name of ULBs	Quantity of Water Drawl	Agreement Executed (Yes/No)
1	Dewas	33 MLD	No
2	Mahidpur	2 MLD	No
3	Alot	1.2 MLD	No
Total		**36.2 MLD**	

(Source: Information provided by the WRD)

Therefore, 36.2 MLD of water is being drawn by these ULBs from Kshipra River without agreement. Thus, there is lack of effective monitoring through installation of flow meter at intake well for ascertaining quantum of water supplied to the consumers as well as water losses, *etc*., on water drawl from Kshipra River.

***Conclusion**: This Hypothesis was found to be true. It was observed that the GoMP has completely deviated from the earlier aim of transforming Kshipra River into a perennial river by infusing Narmada water into Kshipra through the NKSL Project. The project was executed without foresight on future O&M and recurring charges on this account and consequently there are no well-defined objectives about the future course of the project. Further, management of Kshipra water and water provided through NKSL was defective and the mechanism was inadequate.*

5.5 Minor Hypothesis No-18: There is lack of alternative arrangement of water by MPWRD and ULBs for irrigation purpose.

The hypothesis was checked from the data of Water Resources Department and ULBs through various aspects such as whether alternative irrigation pattern and alternative source for irrigation such as gravity dam and canal system, *etc*., were developed by MPWRD and provision for utilization of treated water of STPs for irrigation purpose was made.

[7] ULBs Dewas, Mahidpur and Alot.

Findings on above hypothesis are discussed in detail as below:

5.5.1 Non-development of alternative irrigation pattern and not providing alternative sources for irrigation such as gravity dam and canal system, *etc.*

Alternative irrigation patterns *viz.* dams and canals were not developed by the WRD.

Farmers in Kshipra basin are largely dependent upon Kshipra River. Water Resources Department of Madhya Pradesh is responsible for creation and maintenance of irrigation potential through construction of water resources projects. There are no major project currently working in catchment of Kshipra River. Only two medium projects and significantly low canal system were currently working there. Therefore, farmers along Kshipra River were largely dependent upon Kshipra River water for irrigation. Further, issue of inadequate development of irrigation facilities for surface irrigation has been commented in **Paragraph 6.2.2**.

Audit team, along with IIT, Indore's team and officials of MPPCB/ULBs during sampling for analysis of water of Kshipra River, observed that even though there was very small quantity of water in Kshipra River but water was still being pumped for irrigation purpose as can be seen in the **Image 5.10.**

Image 5.10: Lift irrigation from Kshipra River

(Source: Photo taken by Audit Party during Physical verification)

Therefore, as of now, dependency of farmer on Kshipra River as well as groundwater is higher due to lack of adequate alternative irrigation facility. This is one of the causes for lack of water flow in Kshipra River.

The NVDA replied (December 2022) that a major irrigation project, namely Sanwer Micro Irrigation Project with pressurized pipe canal system had been initiated by the NVDA to address alternative source of irrigation.

5.5.2 Inappropriate provision for utilization of treated water of STPs for irrigation purpose by ULBs

Provision for optimal utilisation of treated sewage water in the irrigation was not made by the ULBs.

NGT's order (673/2018 dated 18 November 2019) emphasised on utilization of treated sewage water so as to minimize extraction of ground or surface water. Further, as per clause 7.3.1.8 of CPHEEO Manual, optimum utilization of sewage in agriculture means complete and judicious use of its three main components, *viz*., water, plant nutrients and organic matter on the farms. Further, Consent given by MPPCB to STPs also emphasise on reuse of treated water of STPs.

Audit observed that there are currently 15 STPs[8] operational in Kshipra River basin through which 354.81 MLD of treated water was generated during 2020-21. Out of 15 STPs, provisions of reuse of treated water is made only for 43 MLD treated water. Remaining 311.81 MLD of treated water was discharged in nearby water bodies.

Details of utilisation of treated sewage water are mentioned in **Table 5.8.**

Table 5.8: Utilisation of treated sewage water

(Volume of water in MLD)

S.N.	Name of ULBs	Designed capacity of all STPs	Treated sewage generated	Provision for reuse
1	Indore	412.5	270.06	13
2	Ujjain	83	83	30
3	Dewas	48	1.75	0
	Total	543.5	354.81	43

(Source: Information provided by the ULBs)

Conclusion: *Hypothesis was found to be true. It was observed that alternative arrangement for irrigation through optimal utilisation of treated sewage water was not being done.*

5.6 Recommendations

Audit recommends that:

- NVDA may ensure sufficient water availability in Kshipra River in lean season and WRD/NVDA may develop a mechanism for making alternative arrangement of water for irrigation purpose.
- The ULBs and Forest Department may develop an effective mechanism for plantation alongside Kshipra River.
- NVDA/WRD may make efforts for the recovery of dues of water supplied through Narmada-Kshipra link from ULBs and may make agreement for the water supplied through Kshipra River.

[8] 11 STPs in Indore, Three STPs in Dewas and one STP in Ujjain.

CHAPTER 6

GROUND WATER AND ITS IMPACT ON RIVER FLOW

6 CHAPTER

Ground water and its impact on River Flow

Sub-Major Hypothesis No-5: Flow of Kshipra River is affected due to decreasing groundwater in the sub-basin.

6.1 Introduction

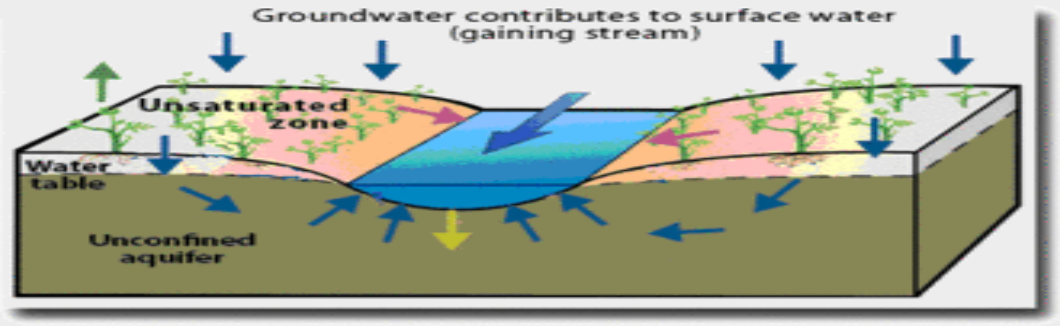
Groundwater is an important source to meet the water requirements of various sectors like irrigation, domestic and industries. Nearly 90 *per cent* of rural domestic water use is based on groundwater while 70 *per cent* of water used in agriculture is pumped from aquifers. Groundwater is also important for the industrial sector in a large measure and if left unregulated, may lead to serious inter-sectoral conflicts. Hence, due to forthcoming growth in agriculture and industrial sectors, management of groundwater resources, particularly the aquifers are challenging. As groundwater level is directly related to the flow in the river, over exploitation of it may adversely affect the flow of river as well.

According to Guidelines/Criteria for evaluation of proposals/requests for groundwater abstraction issued by the CGWA, permission to abstract groundwater through any energized means will not be accorded for any purpose other than drinking water in the notified areas. The CGWB had notified Indore Municipal Area for the above purpose. Other areas of Kshipra sub-basin do not come under the notified area.

According to United State Geological Survey Circular[1], groundwater is an important factor that contributes to river flow. The interaction between streams and groundwater takes place in three basic ways:

- streams gain water from inflow of groundwater through the stream bed (gaining stream),
- streams lose water to groundwater by outflow through the stream bed (losing stream), or
- they do both, gaining in some reaches and losing in other reaches.

[1] It is also referred by the CGWB.



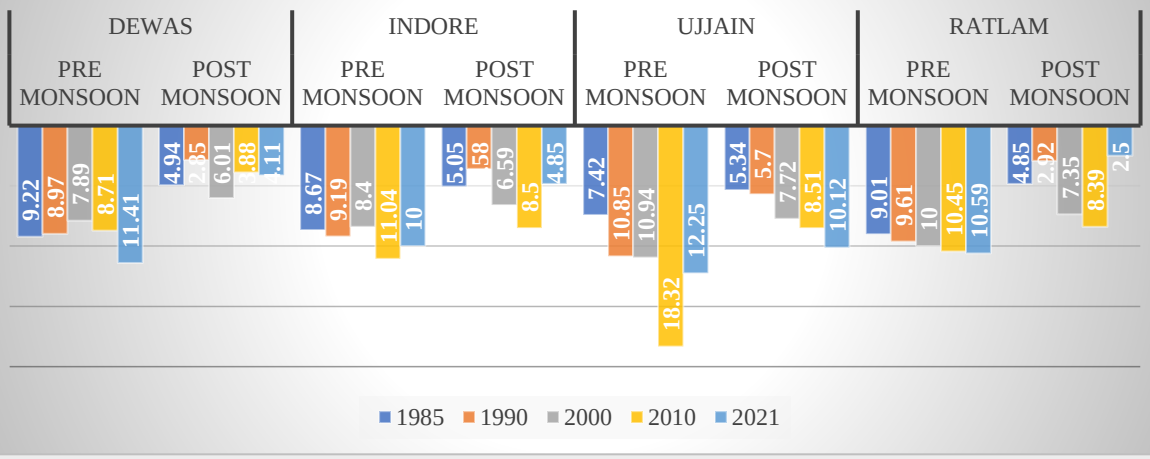
(Source- Open Source)

Surface-water depletion is directly associated with chronic lowering of groundwater levels. The amount of water that is gained by a stream from groundwater is called base flow.

In the context of Kshipra River, CGWB and CWC both stated in their reports[2] that the Kshipra was perennial river up to 1996 but due to over exploitation of groundwater from the watershed, its base flow has become almost dry, even in the monsoon season.

Comparison from 1985 to 2021[3] for the mean water level of Dewas, Indore, Ujjain and Ratlam districts is being done on the basis of data provided by MPWRD. It can be seen that there is severe decline in the pre-monsoon (May) period as compared to post-monsoon (November) levels. Mean water levels in Kshipra sub-basin are shown in **Chart 6.1.**

Chart 6.1: Variation in mean Ground Water depth (in metres)



(Source- Information provided by the MPWRD)

It can be seen from the **Chart 6.1** that the water levels have gone down over the period of years from 1985 to 2021 due to over extraction of groundwater.

As per CGWB (Report on groundwater resources, 2020), the stage of groundwater extraction[4] is a ratio of Annual Groundwater Draft and Net Annual extractable Groundwater resource in percentage. Present stage of groundwater extraction is 57 *per cent* in Madhya Pradesh.

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2 Kshipra Sub-basin Report, 2011 of CWC and Rejuvenation of Kshipra River by CGWB, 2021.

3 Data for 1985, 1990, 2000, 2010 and 2021 were taken for comparison.

4 Ground water extraction (%) = Existing gross groundwater withdrawal for all uses × 100 / Net annual extractable Ground water resource

Net extractable Groundwater resource = Available annual recharge - Natural discharge.

Comparison of gross groundwater extraction for all users with percentage of groundwater extraction between the year 2020 and 2004 are detailed in **Table 6.1**.

Table 6.1: Details of increase in groundwater extraction

(Groundwater extraction in hectare metre)

S.N.	Name of District	Ground water extraction for all users in 2004	Percentage of groundwater extraction in 2004	Groundwater extraction for all users in 2020	Percentage of groundwater extraction in 2020
1	**Indore**	59,426	104	68,797.42	125.97
2	**Dewas**	58,468	66	64,684.74	80.05
3	**Ratlam**	70,882	117	1,07,741.87	141.17
4	**Ujjain**	86,435	109	96,470.3	105.09
Total		**2,75,211**		**3,37,694.3**	

(Source: Dynamic Ground Water Report 2004 and 2020)

It is evident from **Table 6.1** that groundwater extraction for all users had increased to 3,37,694 hectare metres (22.70 *per cent*) in 2020 from 2,75,211 of 2004. The most severe consequence of excessive groundwater pumping is that the water level is depleting.

Reasons of Groundwater depletion have been analysed through various hypotheses, as mentioned in succeeding paragraphs:

6.2 Minor Hypothesis No-19: There is an excess groundwater extraction for industrial and agriculture purposes without proper regulation by authorised agencies.

As per CGWB Report of "Dynamic Ground Water Resource of Madhya Pradesh–2020", existing gross groundwater extraction for all uses was much higher than annual extractable/available groundwater resource. Comparison between total availability of groundwater and total extraction by all users are shown in **Table 6.2**.

Table 6.2: Comparison between availability of water and extraction in Kshipra sub-basin in 2020

S.N.	District	Annual Extractable Groundwater Resource (Ham)	Existing Gross Ground Water Extraction for All Uses	Percentage of Ground Water extraction in 2020
1	Dewas	80,802.06	64,684.74	80.05
2	Indore	54,614.14	68,797.42	125.97
3	Ratlam	76,322.66	1,07,741.90	141.17
4	Ujjain	91,800.84	96,470.30	105.09
Total		**3,03,539.70**	**3,37,694.36**	**104.81**

(Source: Dynamic Ground Water Report 2020)

Total extraction of groundwater for all uses in all the 51 districts of the State is 18,96,752.90 hectare-metres out of which 3,37,694.33 hectare-metres (17.80 *per cent*) of water is extracted by four districts only that fall in Kshipra sub-basin, as shown in **Table 6.3.**

Table 6.3: Details of groundwater extraction for various purposes in Kshipra sub-basin in 2020

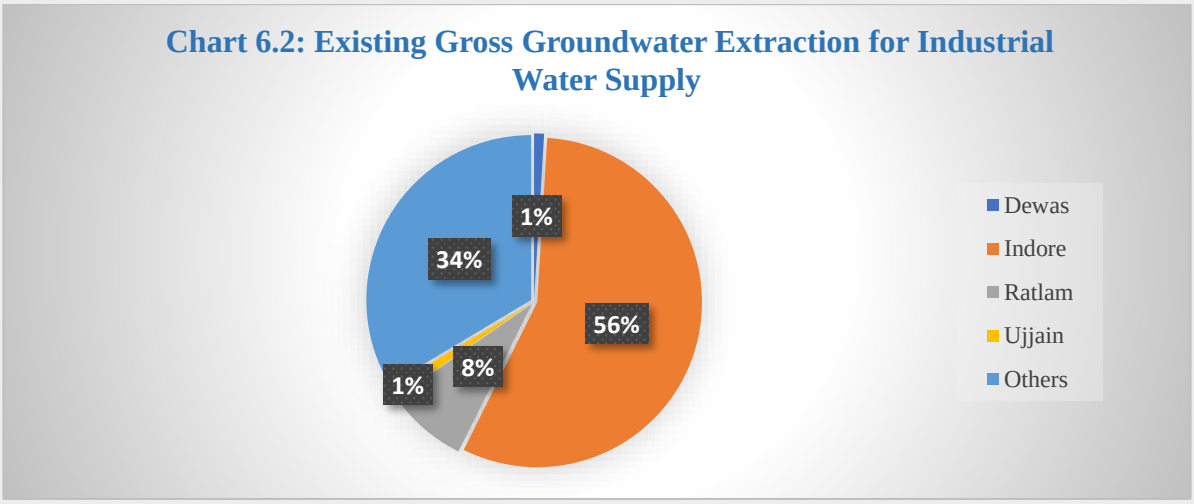
S.N.	District	Existing Gross Ground Water Extraction for Irrigation	Existing Gross Ground Water Extraction for Industrial Water Supply	Existing Gross Ground Water extraction for Domestic Water Supply	Existing Gross Ground Water Extraction for All Uses
1	**Dewas**	60,554.71	25.35	4,104.70	64,684.74
2	**Indore**	59,179.95	1,471.40	8,146.08	68,797.42
3	**Ratlam**	1,03,519.70	208.00	4,014.22	1,07,741.90
4	**Ujjain**	92,923.58	28.84	3,517.88	96,470.30
Total		**3,16,177.94**	**1,733.59**	**19,782.88**	**3,37,694.36**

(Source- CGWB Dynamic Ground Water Report, 2020)

It is evident from the **Table 6.1** that Indore, Ratlam and Ujjain districts are over extracting groundwater. The main reason for depletion of Groundwater in Kshipra sub-basin is its over-exploitation for irrigation purpose, which constitutes 93.63 *per cent* (3,16,177.90 *100 / 3,37,694.30) of total usage.

Further, total groundwater extraction for industries in the State was 2,609.73 hectare-metres. Out of this, 66.43 *per cent* (1,733.59 Ham) was extracted by industries in Kshipra sub-basin as shown in **Chart 6.2**

Chart 6.2: Existing Gross Groundwater Extraction for Industrial Water Supply



(Source: CGWB Report on Dynamic Ground Water Resources 2020)

This minor hypothesis was checked through various aspects, *viz.* groundwater drawl through tube wells by Industries, availability and assurance of monitoring mechanism for groundwater drawl by Industries and drilling of excess tube wells due to huge dependency of farmers on groundwater for irrigation, *etc*. Findings on testing of this hypothesis are discussed in detail in succeeding paragraphs:

6.2.1 Groundwater drawl by Industries without permission of CGWA

Only 16 Industries out of 2,844 were extracting groundwater after getting NOC from the CGWA.

CGWA regulates groundwater extraction and management by issuing 'No Objection Certificates' (NOC) for groundwater extraction to industries, infrastructure projects and mining projects, *etc*. Necessary conditions for implementation by the proponents are laid down in the NOCs issued by CGWA.

As per the CGWA guidelines of the year 2012, only new units and industries (industry, infrastructure and mining projects) seeking expansion, fell under the purview of the guidelines. Further, in the revised guidelines issued in November 2015, all existing industries/projects which were drawing groundwater and had not obtained NOC from CGWA, either due to their establishment prior to formation of CGWA or due to exemption from obtaining NOC as per earlier guidelines, were also required to apply to CGWA with immediate effect for NOC related to groundwater withdrawal.

Audit observed that there were 6,777 industries working in Dewas, Indore and Ujjain. These industries were taking water from various sources, *viz.* tube-wells, dug-wells, municipal water supply, PHED, from the rivers, *etc*., for use in industrial and domestic purposes. Out of 6,777 industries, 2,844 had tube-wells/dug-wells as main source of water supply for industrial use in Kshipra sub-basin. Out of these, only 16 industries had taken permission from CGWB. Details of the number of industries which had taken NOC from CGWB for groundwater drawl are given in **Table 6.4**.

Table 6.4: Number of Industries that have taken permission from CGWB for Ground Water extraction

S.N.	Name of Regional Office of MPPCB	No. of ground water drawing Industries	No. of Industries which have taken NOC for groundwater drawl	No. of Industries drawing groundwater without NOC
1	Dewas	628	3	625
2	Indore	1,717	10	1,707
3	Ujjain	499	3	496
Total		**2,844**	**16**	**2,828**

(Source: data form Central Ground Water Board)

From the **Table 6.4**, it could be seen that 2,828 industries of Kshipra sub-basin are irregularly drawing ground water without permission of CGWB. This had resulted in lack of monitoring for groundwater drawl by CGWB.

Compliance of conditions of NOC, *viz.* non-installation of telemetry digital water meter in the abstraction structure to quantify amount of groundwater abstraction, amount of recycled and reused water leads to minimizing the uses of fresh groundwater. Due to non-conducting annual water audit, these issues could not be monitored as mentioned.

Further, the MPPCB had also not viewed the aforesaid mandatory condition while granting CTO to the industries concerned. This shows lack of co-ordination between CGWB and MPPCB.

Further, CGWB stated that it had requested MPPCB and Department of MSME, GoMP to provide the list of groundwater consumer industries which provided list of around 15,680 consumer industries. As per newly notified Guidelines (September 2020) by CGWA, all new/existing industries, industries seeking expansion, infrastructure projects and mining projects abstracting groundwater, will be required to seek NOC from CGWA. However, till date only 104 (as per CGWA portal) industries had obtained NOC from CGWA. Thus, the fact remains that only a minuscule number of industries were extracting groundwater after obtaining NOC resulting in lack of control over groundwater extraction.

6.2.2 Drilling of excess bore/tube-wells due to huge dependency of farmers on groundwater for irrigation

Dependency of groundwater in irrigation had increased due to lack of alternative arrangements of water for irrigation.

As per the Report[5] published by Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, net irrigated area by tube-wells is 34,70,478 hectares in Madhya Pradesh. Among the districts, the largest net area irrigated by tube-wells is 2,89,778 hectares in the Ujjain district. Further, Dewas and Indore are also dependent for irrigation on tube-wells as shown in **Map 6.1.**

Map-6.1: Net Irrigated Area by Tube-wells

(Source: Report published by Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur)

[5] Agricultural Map of the State of Madhya Pradesh 2021, Part II.

As per Agriculture Census[6] 2018-19, it was noticed that there was a massive increase in tube-wells and dug-wells since 2006-07. Comparison between number of tube-wells and dug-wells in Kshipra sub-basin from 2006-07 to 2018-19 is detailed in **Table 6.5.**

Table 6.5: Details of increase in tube-wells and dug-wells

S.N.	Name of District	Year 2006-07			Year 2018-19			
		Tube-wells	Dug-wells	Total	Tube-wells	Dug-wells	Total	Increase in percentage
1	Dewas	25,938	5,829	31,767	42,926	44,105	87,031	173.97
2	Indore	41,630	3,631	45,261	59,606	9,521	69,127	52.73
3	Ujjain	45,242	14,856	60,098	94,844	32,027	1,26,871	111.11
4	Ratlam	18,897	8,607	27,504	50,527	53,791	1,04,318	279.28
Total		**1,31,707**	**32,923**	**1,64,630**	**2,47,903**	**1,39,444**	**3,87,347**	

(Sources: Website of MP Land Record)

It is clear from **Table 6.5** that numbers of dug-wells and tube-wells had increased from 53 *per cent* to 279 *per cent* from 2006-07 to 2018-19, whereas overall increase in the tube-wells and dug-wells in the state is 49[7] *per cent* only. Following reasons contribute to increase in tube-wells/dug-wells.

➢ Lack of surface water irrigation facilities through Tanks/ Dams and Canals

As per National Water Policy, 2002 clause 16.1 and 16.2, efficiency of utilisation in all the diverse uses of water should be optimised and an awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through education, regulation, incentives and disincentives. The resources should be conserved, and the availability augmented by maximising retention, eliminating pollution and minimising losses. For this, measures like selective linings in the conveyance system, modernisation and rehabilitation of existing systems including tanks, recycling and re-use of treated effluents and adoption of traditional techniques like mulching or pitcher irrigation[8] and new techniques like drip and sprinkler may be promoted, wherever feasible.

Further, as per the "Performance Evaluation Report[9] of selected tank irrigation projects in Kshipra sub-basin", the tank irrigation has a special significance to the marginal and small-scale farmers as these are crucial for irrigation as well as for recharging groundwater in drought prone regions.

As per information provided by the Farmer Welfare and Agriculture Development Department, ground water is a major source of irrigation in Dewas, Indore and Ujjain Districts (Kshipra sub-basin) which constitute 65 to 77 *per cent* of total irrigation during last five years. Comparison between surface (canal and tanks) and ground water (tube-wells) against total agricultural land is depicted in **Chart 6.3.**

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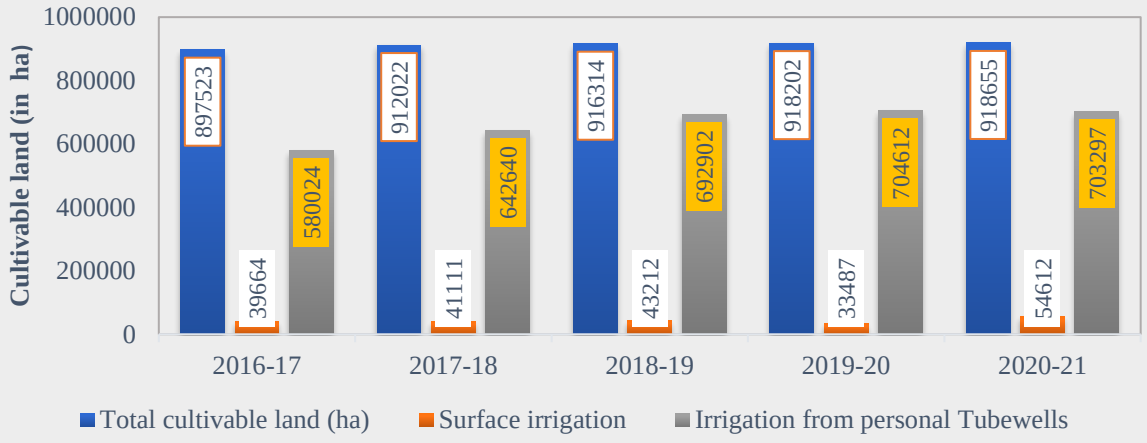
6 Directorate, Land Record under Madhya Pradesh Revenue Department is responsible for maintaining agriculture census, land consolidation and Nazul, *etc*.

7 Increase in the numbers of tube-wells and dug-wells from 18,37,616 (2006-07) to 27,39,227 (2018-19).

8 A method that uses round earthen containers for growing saplings.

9 Published by IIT Roorkee in 2009.

Chart: 6.3 Comparasion of Surface and groudwater Irrigation (in ha)



Despite the well-known fact that eight out of 12 blocks of Kshipra sub-basin come under category of overexploited, as commented in forthcoming **Paragraph 6.3.1** and **Table 6.9**, there was no effective planning to control the continued over exploitation of groundwater, *i.e.*, by means of developing irrigation facility from canal network and tanks.

As per irrigation data of MPWRD, there is no major[10] irrigation scheme in Kshipra sub-basin and there are two medium[11] schemes in Mahidpur having irrigation capacity of 9,280 ha[12] only. Remaining surface irrigation is done from 251 minor[13] irrigation schemes. Further, sufficient minor irrigation schemes were also not developed by MPWRD. Details of irrigation potential developed from the minor schemes during 2015-16 and 2020-21 is given in **Table 6.6.**

Table 6.6: Details of surface irrigation potential developed from minor schemes

S.N.	Name of District	Irrigation potential as on 2015-16		Irrigation potential as on 2020-21		Increase in irrigation potential in last five Year	
		Schemes	Irrigation (ha)	Schemes	Irrigation (ha)	Schemes	Irrigation (ha)
1	Indore	84	9,337	85	9,812	1	475
2	Ujjain	82	19,321	89	20,651	7	1,330
3	Dewas	64	11,952	77	13,922	13	1,970
Total		**230**	**40,610**	**251**	**44,385**	**21**	**3,775**

(Source: MPWRD)

It can be seen from the **Table 6.6** that since 2015-16, only 3,775 ha of irrigation facility had been increased by developing 21[14] minor irrigation schemes, which was only nine *per cent* of available irrigation potential through surface irrigation (tanks and canals) up to 2015-16.

[10] The irrigation schemes (Dam) which are designed to irrigate more than 10,000 ha area.

[11] The schemes (Dam) which are designed to irrigate area above 2,000 ha and less than 10,000 ha.

[12] Amiya Bahadurpur (3,180 ha) and Indokh Barrage (6,100 ha), Mahidpur, Ujjain.

[13] The schemes (Dam) which are designed to irrigate area up to 2,000 ha.

[14] Earthen dams, weirs and barrages, *etc*.

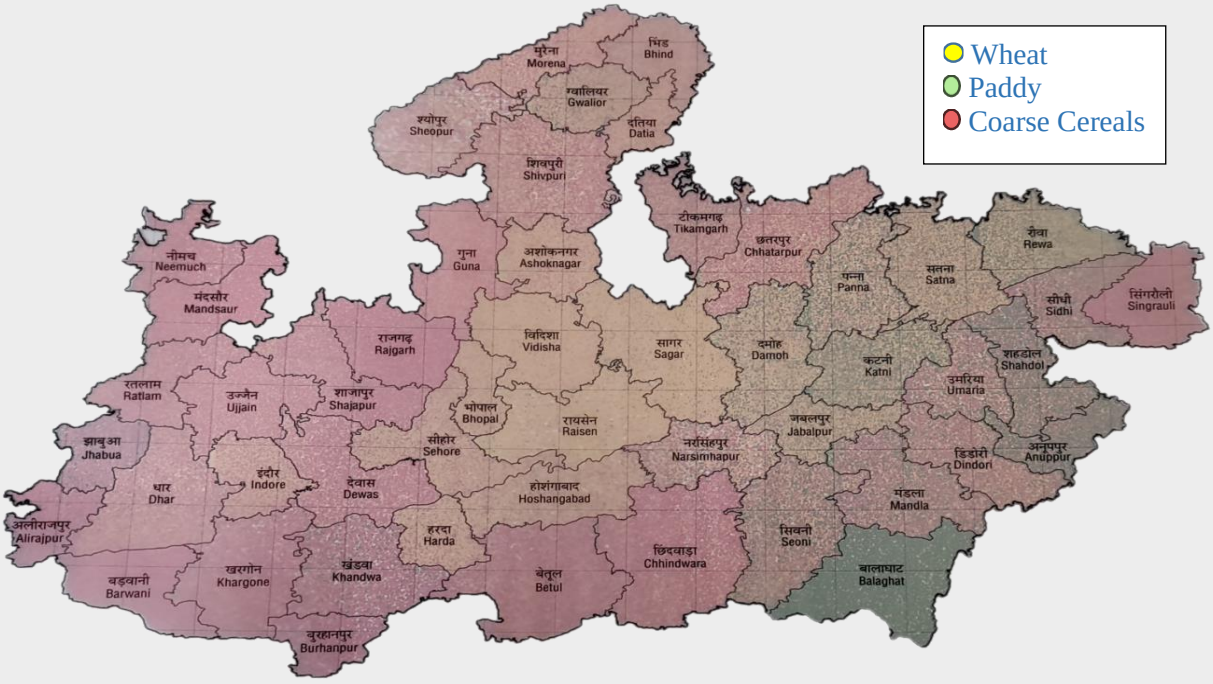
While overall increase in irrigation potential from minor schemes in the state is 19.47[15]*per cent*. Thus, the dependency on ground water had remained elevated.

➢ Change in cropping pattern

As per Agriculture Atlas of Madhya Pradesh, between 1976-81 and 2004-09, quinquennial average of area under cereals has declined by a million hectares. But area under wheat has increased by eight lakh hectares. Area under paddy has also increased by about 1.50 lakh hectares. Area under coarse cereals has correspondingly declined by more than 19 lakh hectares. Decline in the coarse cereals and rise in wheat crop is visible in almost every district.

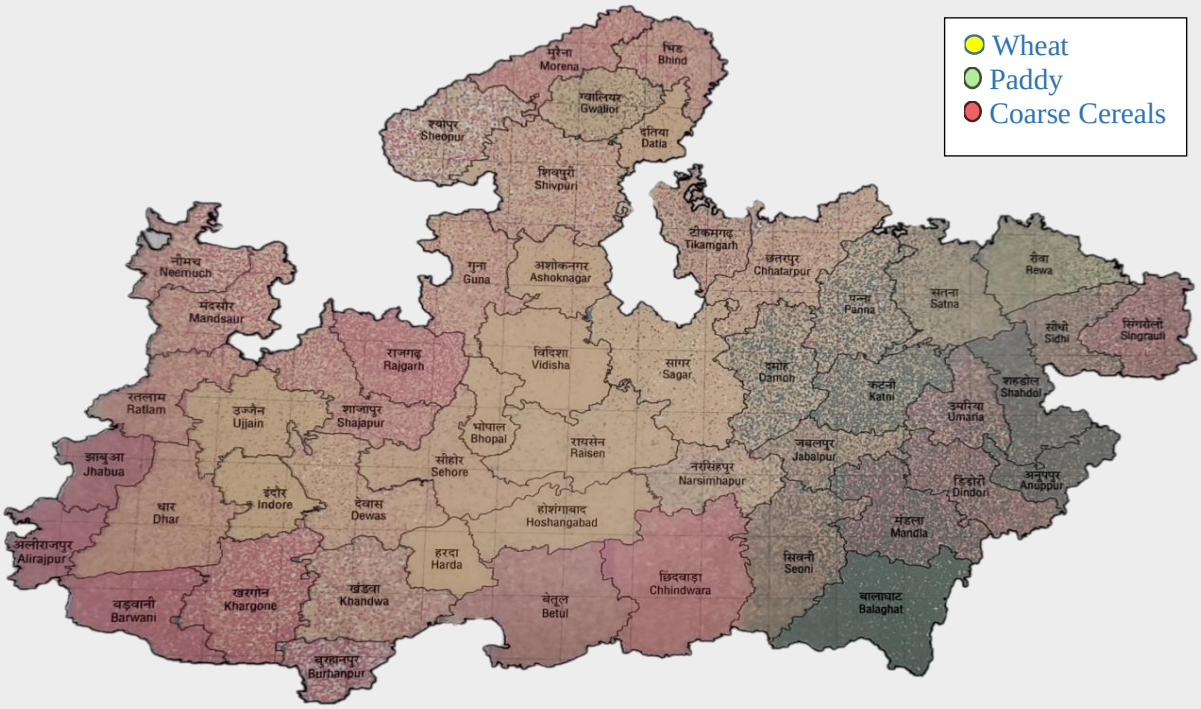
It can be seen from the **Map 6.2 and Map 6.3** that cropping pattern in Dewas, Indore and Ujjain had shifted from coarse cereals towards wheat between 1976-81 and 2004-09.

Map 6.2: Area under different Cereals in 1976-81



[15] Increase of Irrigation potential from 10,15,468 ha (2015-16) to 12,12,832 ha (2020-21).

Map 6.3: Area under different Cereals in 2004-09



It was further observed that there was a major shift in cropping pattern in the basin after 2010 as well. Cultivation of wheat, paddy and sugarcane, *etc*., has widely increased in the basin. It is important to mention that demand of water for these crops is much higher than crops such as coarse cereals cultivated earlier in the basin (**Table 6.7**).

Table 6.7: Change in cropping pattern from 2011 onwards in Kshipra sub-basin

(Area in thousand ha)

S.N.	Name of Crop	2011-12	2015-16	2020-21	Change over last 10 years (*per cent*)
1	Soya bean	1,224	1,245	1,445	Increased by 15.29
2	Maize	73	66	47	Decreased by 35.62
3	Wheat	507	669	1,133	Increased by 123.47
4	Gram	446	374	163	Decreased by 63.45

(Source: Directorate of Land Record)

As per **Table 6.7**, it could be assessed that net sown area of gram and maize has decreased by 63.45 and 35.62 *per cent* respectively, whereas in case of wheat, net sown area has increased by 123.47 *per cent*. This shows that cropping pattern has now shifted towards wheat. As wheat requires more water in comparison with other crops, the dependency on ground water is increasing due to shifting of cropping pattern. Dependency of irrigation has shifted to ground water through increasing numbers of dug-wells/tube-wells, from 1,64,630 to 3,87,347 due to lack of surface irrigation. This has a depleting effect on groundwater table.

Farmer Welfare and Agriculture Development Department, GoMP replied (October 2022) that cropping pattern had changed to increase the area of less water intensive crops, and for this, the farmers were being trained through various workshops. Further, for proper use of ground water, micro irrigation was being promoted through various schemes of the Department.

Reply is not acceptable as trend clearly shows (**Table 6.7**) that cultivated area of more water intensive crops is increasing continuously over the last 10 years, which is impacting the groundwater usage.

- **Subsidised power encouraged the dependency of the farmers on ground water (tube- wells) for irrigation**

As per *Mukhya Mantri Sthayi Krishi Pump Yojna* (MMSKPY) for billing of LV 5.4 Agriculture, flat rate consumers having load up to 10 Horsepower (HP) will be billed only at ₹ 750 per HP per annum. The consumers above 10 HP shall be billed at ₹1500 per HP per annum. Audit observed that electricity meters were still not installed and electricity was being charged on the basis of fixed monthly charges. Huge number of unmetered connections was also one of the causes of indiscriminate extraction of ground water.

Details of district-wise unmetered connections and subsidy provided by the GoMP are given in the **Table 6.8.**

Table 6.8: Details of unmetered connections and subsidy provided by the GoMP

S.N.	Name of District	Number of metered connections	Subsidy provided by GoMP (₹ in crore)	Number of unmetered connections	Subsidy provided by GoMP (₹ in crore)
1	Indore	1,475	6.17	89,135	462.44
2	Dewas	106	0.76	1,25,225	611.11
3	Ujjain	412	1.04	1,51,756	754.27
4	Ratlam	292	0.77	1,25,630	559.92
Total		**2,298**	**8.74**	**4,91,746**	**2,387.74**

(Source: Madhya Pradesh Paschim Kshetra Vidyut Vitran Co. Ltd., Indore)

From the **Table 6.8**, it could be seen that against 2,298 metered connections, there were 4,91,746 unmetered connections in all four districts of Kshipra sub-basin. This was due to flat rate of billing for unmetered connections and consumers don't have to pay electricity bill as per their usage. GoMP had provided subsidy of ₹ 2,387.74 crore during the year 2021-22 for unmetered connections. Thus, there is an uncontrolled groundwater extraction for irrigation which is continuously affecting the water table. The main reason for depletion of groundwater (refer **Table 6.1)** in Kshipra sub-basin is its over-exploitation for irrigation purpose.

GoMP, Energy Department replied (October 2022) that electricity consumers were being billed for electricity usage in accordance with the retail supply tariff order approved by Madhya Pradesh Electricity Regulatory Commission, Bhopal.

However, the fact remains that there is a lack of suitable monitoring mechanism to check the usage of pumps, which has resulted in excess groundwater drawn by farmers for irrigation.

Conclusion: *The Minor Hypothesis is true. It was observed that NOC was not obtained by Industries from CGWB before extracting ground water, water meters were not installed to monitor the actual ground water extraction and dependency of ground water in irrigation had increased due to lack of alternative arrangements for irrigation.*

6.3 Minor Hypothesis No-20: Non-formation/Non-implementation of guidelines of over-exploited zones of ground water which leads to decrease the water table in Kshipra Basin.

Groundwater extraction can alter how water moves between an aquifer and a stream by either intercepting groundwater flow that discharges into the surface-water body under natural conditions, or by increasing the rate of water movement from the surface-water body into an aquifer.

Pumping out of the groundwater faster than it is replenished over the long-term can cause severe problems like, drying up of wells, reduction of water in streams and lakes and deterioration of water quality, *etc*. The volume of groundwater storage is decreasing in most of the areas of Kshipra sub-basin in response to increase in groundwater extraction by all users over a period.

6.3.1 Over-exploited zones in Kshipra sub-basin

Out of total 12 zones in Kshipra sub-basin, eight had been declared over-exploited by the CGWB.

The groundwater resources are assessed at block level by CGWB. These blocks are categorised on the basis of percentage of groundwater extraction. There are four categories, namely, 'Safe' areas which have groundwater potential for development; 'Semi-critical' areas where cautious groundwater development is recommended; 'Critical' areas and 'Over-exploited' areas, where there should be intensive monitoring and evaluation and future ground water development should be linked with water conservation measures.

On the basis of above criteria, categorisation of blocks of Kshipra sub-basin has been done by CGWB and MPWRD. Comparison of percentage of groundwater extraction in the blocks of Kshipra sub-basin between year 2017 and 2020 are detailed in **Table 6.9.**

Table 6.9: Block wise details of exploitation of groundwater

S.N.	Name of District	Name of Blocks	Percentage of Ground water extraction in 2017	Status as on 2017	Percentage of Ground water extraction in 2020	Status as on 2020
1	Ujjain	Barnagar	125.52	Over-exploited	140.37	Over-exploited
		Ghatiya	103.41	Over-exploited	110.85	Over-exploited
		Khachrod	76.75	Semi Critical	83.71	Semi Critical
		Ujjain	128.50	Over-exploited	142.70	Over-exploited
		Mahidpur	78.88	Semi Critical	79.76	Semi Critical
2	Indore	Indore	136.00	Over-exploited	176.55	Over-exploited
		Mahu	71.28	Semi Critical	77.7	Semi Critical
		Depalpur	119.39	Over-exploited	141.85	Over-exploited
		Sanwer	130.56	Over-exploited	120.31	Over-exploited
3	Dewas	Dewas	103.49	Over-exploited	104.83	Over-exploited
4	Ratlam	Alot	113.18	Over-exploited	119.74	Over-exploited

(Source: Dynamic Ground Water Report of CGWA and MP WRD)

It could be seen from the **Table 6.9** that groundwater extraction in all the blocks of Kshipra sub-basin, except in Sanwer, has increased.

6.3.2 Non-formation/non-implementation of regulatory provisions by authorised agencies to control groundwater drawl in over exploited zones

In ULB Indore, there were 1,717 industries extracting groundwater without getting NOC from the CGWB. Guidelines of CGWB were not being followed and alternative source for providing drinking water was also not developed by the PHED.

Although Water is a State subject, the regulation of groundwater abstraction is being done at both Central and State levels. Accordingly, legislation for regulation and development of ground water is to be enacted by the State Governments/Union Territories (UTs). However, the Union Government has circulated a Model Bill to the States and UTs to enable them to enact suitable legislation for regulation and control of groundwater extraction. The Bill was initially circulated in 1970, which has been re-circulated in 1992, 1996 and 2005 for enactment.

The CGWA has been regulating ground water extraction and management by way of issuing 'No Objection Certificates' for ground water extraction to industries, infrastructure projects or mining projects, *etc*., and has framed guidelines in this connection from time to time. These are applicable in 22 States and two Union territories, where groundwater extraction is not being regulated by the State Government and Union territory administration concerned. Madhya Pradesh is also a state where groundwater extraction is being regulated by CGWA.

6.3.2.1 Regulation of groundwater extraction by Central level

Under the Guidelines (November 2015), CGWA had notified 162 critical/over-exploited areas in country for the purpose of regulation of ground water extraction. Permission to abstract ground water through any energized means was not to be accorded for any purpose other than drinking water in the notified areas.

In non-notified areas, ground water withdrawal could be considered for industries/ infrastructure/mining projects also. As per the revised guidelines (September 2020), the system of notifying areas by CGWA has been dispensed with and NOCs are now to be issued by CGWA on the basis of the assessment units viz. safe, semi-critical, critical and over-exploited.

Audit observed that up to September 2020, strict regulation for ground water abstraction was prevailing in notified areas only. Out of eight overexploited areas in Kshipra sub-basin, as detailed in **Table 6.9,** only ULB, Indore comes under category of notified area. There were no strict regulations in respect of the remaining areas. CGWB should have ensured implementation of its guideline through State Agencies in notified area. However, CGWB had failed to do so, which has been discussed in **Paragraph 6.3.2.2** below.

The CGWB replied (October 2022) that Indore district is a notified area as per old CGWA guidelines. However, as per new CGWA guidelines, there is no notified area and all water

consumers are mandatorily required to obtain NOC from CGWA for ground water extraction, except the categories of (i) Individual domestic consumers in both rural and urban areas for drinking water and domestic uses (ii) Rural drinking water supply schemes (iii) Armed Forces Establishments and Central Armed Police Forces establishments in both rural and urban areas, (iv) Agricultural activities and (v) Micro and Small Enterprises drawing ground water less than 10 Cu.M./day.

However, due to non-availability of proper guidelines for regulating ground water abstraction in non-notified areas up to September 2020 and improper implementation of guidelines of notified area, there was over exploitation of ground water in Kshipra Basin.

6.3.2.2 Ground water exploitation against prevailing Guidelines

- **Non-compliance of Guidelines of CGWB**

i) Prior to September, 2020, ULB, Indore was the only notified area as per CGWB and permission (NOC) to abstract ground water was not supposed to be accorded for any purpose other than drinking water but against the guidelines, 1,717 industries situated in ULB, Indore, were abstracting ground water.

ii) Revised Guidelines (2015) of the CGWA had restricted diameter of tube-wells to 150 mm (six inches) and pump capacity to five HP in the notified areas. In case of Governmental water supply agencies and housing societies, tube-well diameter and pump capacity could be higher depending upon availability of ground water and requirement. It further added that permission will be given subject to the condition that installation of water meter and construction of rainwater harvesting structure in the premises shall be ensured within 45 days of issuance of NOC. The Authorized Officer will confirm the construction of rainwater structure along with its due verification.

It was noticed that in contravention of the aforesaid guidelines, the PHED had drilled 881 tube-wells of 200/150 mm dia in the Indore notified area during 2016-21 without installing water meters in these tube-wells. Further, water recharging structures in none of these tube-wells were constructed by the PHED. This is one of the major causes of depletion of ground water table (refer **Chart 6.1)** in that vicinity.

- **Non-development of alternative sources for drinking water to reduce dependency on *Ground water***

The CGWA had declared (2017) most of the area of Dewas, Indore and Ujjain districts as over-exploited and the water table is rapidly lowering in these districts, as discussed in **Paragraph 6.3.1**. Despite these circumstances, instead of developing alternative sources, such as dams, barrages, *etc*., for water supply, selected PHE Divisions are drilling tube- wells (**Table 6.10**) regularly in these over exploited zones of Kshipra sub-basin. Furthermore, remedial measures such as artificial recharging structures were not adequately constructed to enhance the ground water table as mentioned in **Paragraph 6.4.1**.

Table 6.10: Details of drilling of tube-wells in the over-exploited areas

S.N.	Name of District	Name of the Block	Year				
			2016-17	2017-18	2018-19	2019-20	2020-21
1	Indore	Indore	31	40	272	88	60
		Sanwer	24	32	50	170	158
		Depalpur	19	186	89	155	01
		Total Indore	**74**	**258**	**411**	**413**	**219**
2	Dewas	**Dewas**	**29**	**28**	**12**	**22**	**111**
3	Ujjain	Barnagar	82	61	69	41	13
		Ghatiya	83	64	45	31	17
		Ujjain	61	35	27	25	20
		Total Ujjain	**226**	**160**	**141**	**97**	**50**
Grand Total			**329**	**446**	**564**	**532**	**380**

(Source: MP Public Health Engineering Department)

Conclusion: *The Minor Hypothesis is mostly true. CGWB did not form guidelines for seven over-exploited blocks of Kshipra Basin. However, for remaining one block of ULB Indore (as notified area) for which guidelines were formed, these were not being followed by the State agencies.*

6.4 Minor Hypothesis No-21: There is an improper planning and execution of Ground Water Recharge works.

CGWB is the nodal agency for providing guidance and technical support in the work of artificial recharging of ground water to the State Government. At State level, no single department is responsible for execution of ground water recharge works. Various departments of the State Government, viz. Public Health Engineering Department, Forest Department, ULBs and Panchayat Raj Institutions, as per their mandate, are engaged in the artificial recharging of ground water.

6.4.1 Inadequate planning for ground water recharge by PHED/CGWB /WRD/Forest Department

There was a deficit of 30,499.05 hectare metre between ground water extraction and artificial recharging. Further, artificial recharging was not executed by the PHED and Forest Department. The ULBs, except, Indore, had also not executed sufficient artificial recharging.

The total annual ground water potential obtained for the unit refers to the available annual recharge after allowing for natural discharge in the monsoon season in terms of base flow and subsurface inflow/outflow. This annual ground water potential includes the existing ground water withdrawal, natural discharge due to base flow and subsurface inflow/outflow in the non-monsoon season, and availability for future development.

Hence, ground water recharge is a basic pre-requisite for efficient groundwater resource development, and this is particularly vital for Kshipra sub-basin where eight blocks, out of 12, comes under over-exploited category due to huge groundwater extraction.

Natural recharge of groundwater can be broadly categorised into two parts, *i.e.*, recharge from rainfall as well as recharge from other sources, viz. canals, surface water irrigation, groundwater irrigation, tanks/ ponds, water conservation structures and from the pipelines.

In Kshipra sub-basin, total ground water withdrawal, net ground water recharge and stage of groundwater extraction are detailed in **Table 6.11.**

Table 6.11: Details of differences between annual groundwater extraction and recharging

S.N.	District	Existing Gross groundwater extraction for all uses	Net groundwater recharge	Stage of groundwater extraction (in percentage)
1	Dewas	64,684.74	80,802.06	80.05
2	Indore	68,797.42	54,614.14	125.97
3	Ratlam	1,07,741.9	76,322.66	141.17
4	Ujjain	96,470.3	91,800.84	105.09
Total		**3,37,694.36**	**3,03,539.70**	

(Source: CGWB)

From the **Table 6.11,** it is clear that there is excess ground water withdrawal in comparison to natural ground water recharge. Thus, there is a need for artificial recharging to enhance availability of groundwater and utilize rainwater for sustainable development to increase infiltration of rainwater in the subsoil, which has decreased drastically in urban areas due to covering of open areas by concrete structures.

Artificial recharge work executed by CGWB and different State agencies has been discussed in the Paragraphs below.

➢ Planning and execution for artificial recharge of ground water by CGWB

CGWB had prepared a Master Plan for artificial recharging of ground water in the year 2013. As per this Plan, 17,763 artificial recharge structures had to be constructed in Kshipra sub-basin, as detailed in **Table 6.12**.

Table 6.12: Artificial recharge structures to be constructed in Kshipra sub-basin

S.N.	District	Details of recharge structure to be constructed				
		PT[16]	CD	RS	NB	CP
1	Dewas	123	1,659	1,659	3,041	507
2	Indore	33	267	489	489	81
3	Ratlam	89	728	728	1,335	223
4	Ujjain	181	1,481	1,481	2,716	453
Total		**426**	**4,135**	**4,357**	**7,581**	**1,264**

(Source: CGWB)

Artificial recharge studies and roof top rainwater harvesting were taken up by CGWB in collaboration with State Government Departments and NGOs under Central Sector Schemes and impact assessment studies were also carried out. The schemes were completed in Indore City, Sonkatch, Bagli blocks and Londri Nala in Dewas District, Ratlam district and Narwar Micro Watershed in Ujjain District.

[16] Percolation Tank (PT), Check Dam (CD), Recharge Shaft (RS), Nala Bund (NB) and Cement Plug (CP).

CGWB stated (October 2022) that they had prepared an Aquifer Mapping Report and block wise demand and supply side management plan. However, last Aquifer Mapping Report had been published in December 2016 and no further Reports were found to have been published by CGWB since then.

➢ Deficiency in execution of artificial recharging by the Forest Department

Forest Department is engaged in the execution of soil and water conservation works, viz. contour trench, gully plugging, stop dam, nala closure and *nistar*[17] tanks, through *Van Samities.*

Audit, however, noticed that though soil moisture and water conservation works were included in the Working Plans[18] of the selected Forest Divisions, but as per information provided by respective Forest Divisions, none of the Divisions had executed these (artificial recharging) works.

The Forest Department, GoMP stated (October 2022) that some Ground water recharge works were executed at Kshipra Basin. However, details of works executed were not provided by the Forest Department to substantiate the reply. Further, reply was also contradictory as the respective Forest Divisions had already accepted non-execution of any such artificial recharging works. The department did not substantiate its claims through documented evidences.

➢ Deficiency in execution of artificial recharging by the Urban Local Bodies

The Urban Local Bodies are engaged in execution of conservation of the natural water sources along with artificial recharging of the ground water in their vicinities.

Audit, however, noticed in the selected ULBs that out of six ULBs, only Dewas, Indore and Ujjain had constructed recharging structures. Remaining ULBs, Alot, Mahidpur and Sanwer had not constructed any water recharging structure, as detailed in **Table 6.13**.

Table 6.13: Details of artificial works done by the ULBs

Name of the ULBs	Dewas	Indore	Ujjain	A lot	Mahidpur	Sanwer	Total
No. of structure constructed	15	10,868	99	0	0	0	10,982

(Source: Selected ULBs)

From the **Table 6.13**, it could be seen that ULB Indore have done comparatively better work in this regard while other have not created these structures sufficiently. Thus, groundwater extracted by ULBs could not be compensated.

➢ Improper execution of artificial recharging by the Panchayat Raj Institutes

The Gram Panchayats are major authorities involved in execution of water conservation and water harvesting structures to augment and improve groundwater like underground Dykes, Earthen Dams, Stop Dams, Check Dams with special focus on recharging groundwater including drinking water sources, *etc*.

[17] These are used for providing drinking water to the cattles, washing and other *nistar (*domestic*)* purposes, *etc*.

[18] Working plan includes the area-specific scientific prescriptions for proper management of forests of a particular Forest Division.

There are 212 villages under the 140 Gram Panchayats situated along the Kshipra and Kahn Rivers in four districts of the Kshipra sub-basin. Districts wise details of artificial recharging structures constructed by the Gram Panchayats are given in **Table 6.14**.

Table 6.14: Details of artificial recharge structures constructed by the PRIs

S.N.	Name of Districts	No. of villages along Kshipra and Kahn Rivers	No. of villages where no structures were constructed	No. of Stop Dams/Check Dams constructed	No. of Percolation tanks constructed	No. of Recharge Shafts constructed	No. of Recharge pits constructed	No. of other structures constructed
1	Indore	63	18	49	0	0	329	301
2	Ujjain	102	12	128	106	0	272	328
3	Ratlam	16	10	8	0	3	0	0
4	Dewas	31	3	3	14	0	49	82
Total		**212**	**43**	**188**	**120**	**3**	**650**	**711**

(Source: Panchayati Raj Directorate)

From the **Table 6.14,** it is clear that out of 212 villages, 43 had not constructed any recharging structures. However, remaining 169 village had constructed various types of recharging structures such as, Stop Dams/Check Dams, Percolation Tanks, Recharge Shafts, Recharge Pits, *etc*. Out of these 169 villages, 29[19] villages, which have constructed various water recharging structures and done plantation during the period 2016-21 were physically verified with officials/staff of PRIs. Following irregularities were observed during Joint Physical Verification:

➢ Non-existence of Water recharging structures

In the Joint Physical Verification of water recharging structures in the selected villages of Indore, Ujjain and Dewas, it was noticed that water recharging structures such as Stop Dams/Check Dams, Percolation Tanks and Soak Pits/other water recharging structures were not found in the stated locations as detailed in **Table 6.15.**

Table 6.15: Details of Recharging structure not found during Joint Physical Verification

S.N.	Name of Zila/ Janpad Panchayat	Name of Gram Panchayat/ Village	Type of water recharging structures not found
1	Ujjain/ Ujjain	Jamalpura/ Magariya	01 Percolation Tank
2	Ujjain/ Ghatiya	KagdiKaradiya/ Kagdikaradiya	08 Other Recharging structures
3	Ujjain/Ghatiya	BhilKheda/ Borkhedi	01 Stop Dam 02 Recharge Pits 06 Other Structures
4	Ujjain/Ghatiya	Ramgarh/Ramgarh	01 Percolation Tank
5	Ujjain/Mahidpur	MundlaParwal /MundlaParwal	11 Soak Pits
6	Ujjain/Mahidpur	DelchiKhurd/ DelchiKhurd	04 Soak Pits
7	Dewas/ Dewas	Timariyachota/ Parvatipura	01 Recharge Pit

[19] 29 village of 28 Gram Panchayats were sampled based on number of plantation and recharge structures.

➢ Recharge Structures which were not functioning

During Joint Physical Verification of water recharging structures, few were found not functioning due to various reason such as cracks in body wall of barrage, filling with earth/silt, vegetation, damage of gates, *etc*., as detailed in **Table 6.16**.

Table 6.16: Irregularities observed during Joint Physical Verification

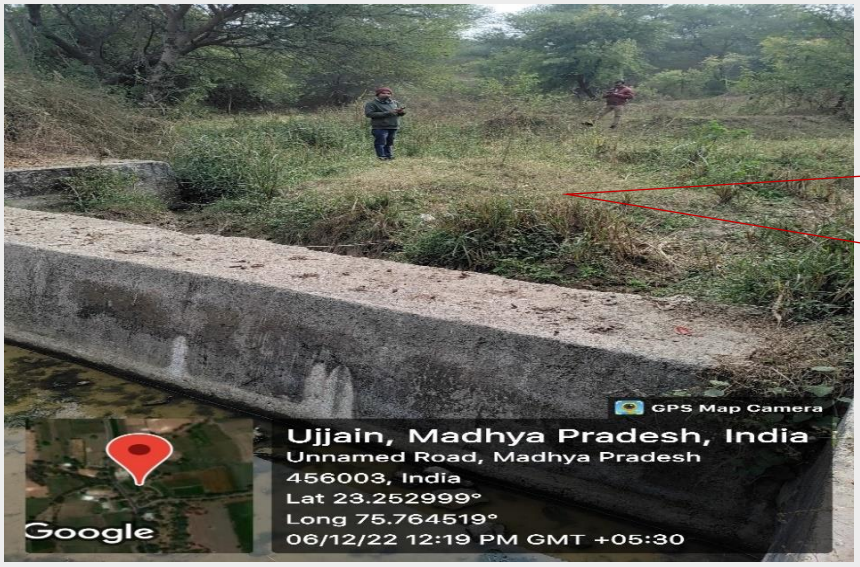
S.N.	Name of Zila/ Janpad Panchayat	Name of Gram Panchayat/ Village	Audit Observation During Joint Physical Verification
1	Ujjain/ Ghatiya	Kaluheda/ Kaluheda	Leakage from the body wall was observed in one stop dam, constructed in 2020-21.
2	Ujjain/ Ghatiya	Bhilkheda/Borekhedi	One percolation tank was not functioning due to improper maintenance.
3	Ujjain/ Ghatiya	Ramgarh/Ramgarh	One stop dam was completely filled with earth/silt in the upstream up to stop dam level.
4	Ujjain/ Ghatiya	Kaliyadeh/ Kaliyadeh	Two stop dams were not working as per their capacity as upstream was filled with earth and vegetation. Remaining five stops dams also having defects, due to which purpose of ground water recharge was not fulfilled.
5	Ujjain/Mahidpur	Mundla Parwal /Mundla Parwal	One check dam, two soak pits and one percolation tank were not in working condition due to improper maintenance (gates of check dam were completely damaged). Hence, no ground water recharging was done by these structures.
6	Ujjain/ Mahidpur	Delchi Khurd/ Delchi Khurd	Three soak pits and two percolation tanks were not in working condition due to improper maintenance and flaw in planning. Hence, no groundwater recharging was done by these structures.
7	Ujjain/ Mahidpur	Jhutawad/ Jhutawad	10 soak pits were not functioning as they were not planned well, and water was not reaching up to soak pits from nearby areas.
8	Ujjain/ Mahidpur	Sagawali/ Sagawali	Four soak pits and one percolation tank were not in working condition due to improper maintenance and flaw in planning. Hence, no ground water recharging was done by these structures.
9	Dewas/ Dewas	Barai/Barai	One recharge pit was not in working condition due to improper maintenance and flaw in planning. Hence, no ground water recharging was done by this structure.
10	Dewas/ Dewas	Timariya/ Parvatipura	One recharge pit was not in working condition due to improper maintenance and flaw in planning. Hence, no ground water recharging was done by this structure.
11	Indore/ Indore	Garya/Garya	One check dam was completely damaged which was constructed in 2019-20 and was not serving any purpose.

Physical verification photos of some water recharging structure which were not in working condition is shown in the **Images 6.1 to 6.3**.

Images 6.1, 6.2 and 6.3: Water recharging structures not in working condition

Stop Dam in Garya village, Indore in completely damaged state.

Gate of Stop Dam is completely broken in Mundla-Parwal village in Ujjain District, therefore, structure is unable to retain water.



Stop Dam completely filled with earth/silt in Ramgarh village in Ujjain District.

From the above, it is very clear that due to improper functioning of these water recharging structures, purpose of recharging/ enhancing groundwater in the vicinity of Kshipra sub-basin was not fulfilled.

The Directorate of PRI replied (October 2022) that ground water recharge works for enhancing ground water level were executed by the PRI under MGNREGA, Watershed schemes and 15th Finance Commission funds. However, no comment was offered with regard to shortcoming in water recharging works.

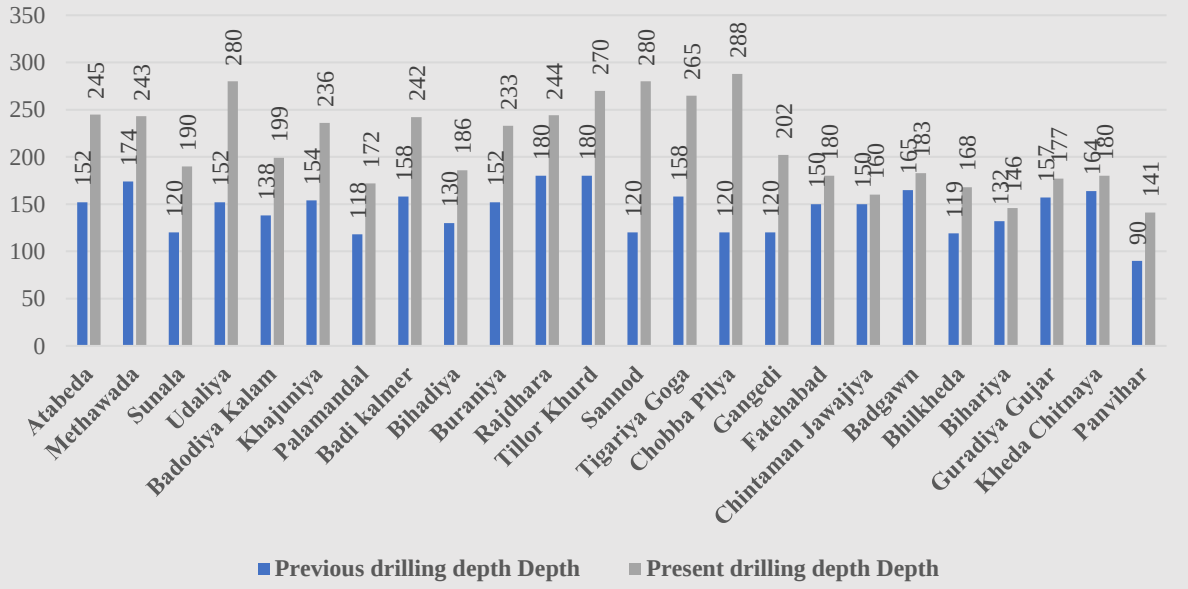
- **Non-adoption of artificial recharging methodologies to control depletion of groundwater level by the PHED**

As per CGWB, artificial recharge practices in rural areas should be taken up earnestly to improve the ground water situation. The case study on "Artificial recharge for groundwater sustainability in Basaltic Terrain" by the CGWB brought out that the watershed can be conserved through simple artificial recharge structures like percolation tanks and check dams. It also improves the ground water levels in the command areas of these structures. Further, implementation of ground water recharge and enrichment schemes and rainwater harvesting, *etc*., for the stability of the sources of water supply schemes is one of the PHED objectives.

Seven[20] out of 11 blocks of Dewas, Indore and Ujjain districts are categorized as over exploited and covered under basaltic terrain, therefore, recharging structure as per above CGWA study is more favourable to augment the ground water level. Audit, however, noticed that adequate efforts were not made for augmentation of ground water level in these districts by PHED. It was further noticed in 24 villages of Dewas, Indore and Ujjain districts that water table had depleted and had decreased between 10 and 168 m and depth of tube-wells had increased from 120 m to 288 m between 2008-09 and 2020-21, as detailed in **Chart 6.4.**

[20] Dewas (Dewas); Indore, Sanwer and Depalpur (Indore); Barnagar, Ghatiya and Ujjain (Ujjain).

Chart 6.4: Details of variation in the depth of tube-wells



(Source: Selected Divisions of MP Public Health Engineering Department)

Action in terms of depleting ground water and their rectification by constructing recharging structures was not taken by the selected PHE Divisions.

Further, the PHED had issued several directions and guidelines for ground water recharge and provision for water security and sustainability was mandatory part of various programme at planning phase, but compliance to these guidelines was not made by selected four PHE Divisions properly during execution. Details of PHED Guidelines and Audit Observations are given in **Table 6.17**.

Table 6.17: Details of PHED Guidelines and Audit Observations

S.N.	Provision regarding ground water recharge	Audit Observations
1	The PHED instructed that provision for water security and sustainability had to be included in the DPRs for execution of Piped Water Supply Schemes (PWSS). Further, as per technical specification, a suitable recharging structure/ arrangement as per guideline of the department has to be provided in the scheme.	Audit noticed that though 7,146 tube-wells were drilled in the selected PHE Divisions during 2008-09 to 2020-21 but neither the provision for recharging pits was made in the estimates/DPRs nor these were constructed in any of the tube-wells under the PWSS.
2	Unified Schedule of Rates of PHED, enforced from 3rd July 2018, mandatorily provides construction of recharging pits in submergence area/around existing tube-wells.	In none of the estimates/DPR, items of construction of recharging pits were included. However, construction of soak pit was provided for recharging the ground water in the estimates of 4,058 out of 7,146 tube-wells only. Even these soak pits were not constructed by respective Divisions.
3	Under Jal Kranti Abhiyan, the E-in-C, PHED directed (June 2016) to prepare a plan for ground water recharge work in four-five villages of each district, which in turn may be approved by State Level Scheme Sanctioning Committee (SLSSC).	Selected PHE Divisions had neither submitted the proposals for ground water recharge nor had the Apex Office taken any action against the officers concerned for non-compliance of orders. This results in non-attention to augmentation of

S.N.	Provision regarding ground water recharge	Audit Observations
		ground water recharge by the department.
4	As per Annexure-II of National Rural Drinking Water Programme (NRDWP) guidelines (2009), with a view to arrest rapid decline in ground water, the Department had to shift the focus from 80 *per cent* groundwater-based systems to 20 *per cent* and the remaining by combination of roof-water harvesting, ground water recharge and surface water harvesting as conjunctive use.	Indore, Sanwer and Depalpur blocks of Indore district were categorized as over exploited zones but drilling of tube-wells in these blocks had increased sharply in comparison to the previous years.
5	The PHED in its ground water recharge Guidelines had given priorities to the work of sustainability of ground water through ground water augmentation, recharging and conservation for safe and clean drinking water to its rural habitants. It was proposed to erect one recharge shaft to the selected villages either where rural pond area lies in between 4,000 to 10,000 sq. m. or in the area of 10,000 sq. m. (100 m X 100 m).	No recharging pits were constructed to augment the groundwater level. It is pertinent to mention that the PHE, Indore Division constructed various structures like check dams, roof water harvesting and recharge shafts in the year 2011-12 to 2015-16 at a cost of ₹ 8.52 crore but after that neither proposals were sent to higher authorities nor were any steps taken to augment the ground water level.
6	The E-in-C, PHED, Bhopal directed (April 2019) that the Divisional Officer shall prepare a work plan regarding construction of recharge shaft up to April 2019. In this regard, it was also stated that recharge shaft should be constructed through PWSS and in habitations belonging to safe drinking water scarce region. Further, recharge plan of tube-wells up to a distance of 500 m should also be prepared and submitted to E-in-C, PHED.	In PHED Ujjain, the Divisional Officer had not submitted the proposals for the construction of recharge shaft. EE, Dewas had submitted (February 2020) a proposal for the construction of recharge shaft amounting to ₹ 142.98 lakh. No records pertaining to the construction of the above structures vis-à-vis any progress reports, change in aquifer sub strata level records were available.
7	Jal Jeevan Mission (JJM) envisions to provide safe and adequate drinking water through individual household tap connections by 2024 in rural India. The programme will also implement source sustainability measures as mandatory elements such as recharge and reuse through grey water management, water conservation, rainwater harvesting.	The PHE Division Indore has not included provision for source sustainability measures, *i.e.*, recharge and reuse through grey water management, water conservation, rainwater harvesting in the estimates as mandatory elements. Thus, the Department was unable to achieve the envisaged objectives of implementation of JJM with regards to recharging the ground water.

6.4.2 Aquifer mapping was not done by authorised agency for Groundwater recharging

Work of aquifer mapping for long-term sustainability of local ground water resources was not done by the PHED.

- **Aquifer mapping not done by the PHED**

An accurate and comprehensive micro-level picture of ground water through aquifer mapping in different hydrogeological settings would enable robust ground water management plans at the appropriate scale to be devised and implemented. This would help in achieving drinking water security, improved irrigation facility and sustainability in water resources development.

The CGWB had published (2013) "Manual on Aquifer Mapping" which attempted to evolve uniform protocols for various activities such as collection and compilation of available information on aquifer systems, demarcation of their extents and their characterisation, analysis of data gaps, generation of additional data for filling the identified data gaps and preparation of aquifer maps at the desired scale.

Audit noticed in the selected PHE Divisions that the Divisional Officers had not sent any proposal to the competent authorities to prepare micro level plans to facilitate implementation of various supply and demand side interventions to ensure long-term sustainability of local ground water resources vide aquifer mapping. Therefore, eventually, it leads to non-formulation of any concrete methodology to check the underground water depletion.

The EEs stated that the work of aquifer mapping was not made as there was no allotment received from the Government nor any instructions were received from the higher offices for aquifer mapping.

However, preparation of ground water management plans at the appropriate scale should have been done to ensure drinking water security, improved irrigation facility and sustainability in water resources. This would only be possible through aquifer mapping vis-à-vis recharging plan.

6.4.3 Impact of water injected in different levels of Ground water was not assessed

Analysis for impact of water injected through artificial recharge was not done by the Government. Further, recharging structures were not being maintained by the PHED.

➢ Impact assessment of recharge structures not being done

As per the CGWB Guidelines[21], artificial recharge structures scheme can either have direct or indirect impacts viz. rise in water level, increase in cropped area, increase in the area cultivated with water intensive crops or with the existing cropping pattern, increase in yield of wells, maintenance of water level/yield of wells/command area during years of deficit rainfall, improvement in quality and increase in vegetation cover in surrounding areas, increase in non-seasonal flow in the streams/rivers and less frequent development of cracks in soil due to increased soil moisture.

The impact assessment should commence prior to initiation of construction of artificial recharge structures and should ideally continue for at least two water years after construction. It was noticed that 274 artificial recharge structures at a cost of ₹ 12.39 crore were constructed by these PHE Divisions during 2008-17. Audit, however, noticed that no such analysis was done by the PHE.

The EEs stated that the amount for the element of groundwater augmentation and fund allotment were not made by the Government in the administrative approval, hence, the work of groundwater augmentation was not done. The sustainability related works such as

[21] Impact Assessment of Artificial Recharge Structures.

construction of recharge shafts, roof water harvesting, *etc*., were executed by Zila Panchayat/ Rural Engineering Service Department.

However, due to lack of monitoring of constructed shafts, the Department could not ensure to fulfil the objectives of artificial recharging from these shafts.

➢ Non-installation of piezometers for monitoring the ground water level

Piezometer is used for measuring the water level and sampling of water quality purpose in the tube-wells/ bore-wells by lowering the tape or via automatic water level measuring equipment. CGWB guidelines for ground water abstraction (November 2015), *inter alia* stipulated that piezometer for monitoring the ground water level is to be installed and water levels should be measured monthly. These guidelines are mandatory for all agencies which are managing ground water.

Audit noticed non-installation of piezometers in the tube-wells drilled by the selected PHE Divisions, due to which, change in water level could not be monitored.

The EEs stated in December 2021 and January 2022 that no such instruction from higher offices had been issued. Through, in some places, CGWB had installed piezometers for monitoring the ground water level.

However, non-installation of piezometers is against the guidelines of CGWB and has ultimately resulted in non-identification of areas where water level is lowering.

➢ Non-maintenance of recharging structures

As per manual for Artificial Recharge of Ground Water by CGWB, periodic maintenance of artificial recharge structures is essential because infiltration capacity reduces rapidly as a result of silting, chemical precipitation and accumulation of organic matter.

Audit noticed in the selected PHE Divisions that artificial recharging structures, viz. Check Dams/Stop Dams/Recharging Shafts/Recharging Pits constructed at a cost of ₹ 12.39 crore during the period 2008-09 to 2016-17, were not being maintained since construction, as detailed in **Table 6.18.**

Table 6.18: Non maintenance of recharging structures

S. N.	Name of the Division	Details of works	No. of Structures	Cost (₹ in lakh)	Details of maintenance
1	PHE, Dewas	Check dams/Stop dams/Recharging Shafts/Recharging pits	42	90.93	NIL
2	PHE, Indore	Check dams/Stop dams/Recharging shafts/Recharging pits	120	852.21	NIL
3	PHE, Ujjain	Check dams/Recharging shafts/ Recharging pits	112	296.10	NIL
Total			**274**	**1,239.24**	

(Source: MP PHED)

The EEs stated that all the recharging structures previously constructed by the Division were in good condition at the time of construction. Further, neither instructions regarding ground water recharging were given by higher offices nor was any allotment received for maintenance.

However, non-maintenance of structures will lead to silting, chemical precipitation, and accumulation of organic matter which would ultimately defeat the purpose of this work.

➢ Joint Physical Inspection of artificial recharge structures

The Narwar Micro Water Shed, Narwar, District Ujjain was constructed (June 2015) by the PHE Division, Ujjain under the direction of CGWB. Followings shortcomings were noticed during Joint Physical Inspection:

i) Non-maintenance of constructed water recharge structures

The recharge pits were not being maintained properly as vegetation, dry soil, garbage and mud layers were seen on the upper layer instead of coarse sand layer. Due to non-maintenance of proper recharge structures, the extent of freshwater recharge could not be ascertained.

ii) Piezometers and Gabion structures were not found

Piezometers are used for measuring ground water level. Gabion structures, which are built with boulders/quarried stones and wired mesh for retaining wall/erosion of soil, sea walls, hydraulic works and channels lining, *etc*., were not found constructed at Bhanwari and Bolasa village. Piezometers were present at Harnawda village, but the measuring instruments (logging box with deflection meter) were not found. Gabion structure at Harnavda village was not as per drawing and design and it was almost destroyed. Hence, the purpose of watershed management was defeated.

Image 6.4: View of damaged Gabion structure at Harnvada village

Image 6.5: Piezometer which was not found at Bhanwari Village

iii) Non-maintenance of stop dams, recharge shafts and ponds

Stop dams, recharge shafts and ponds were constructed at the places mentioned in the DPR. However, level of pond had increased due to heavy silting. Mud, grass and bushes were found around the constructed stop dams and recharge shafts. Recharge shaft was not found at Bhanwari and Bolasa village. It was stated by the department officials that the said shaft was submerged in the pond.

Image 6.6: View of Stop Dam covered by Mud, Grass and bushes

The EE, PHE Division, Ujjain stated (December 2021) that this work was constructed using the Central Fund of CGWB and after construction, no allotment was received either from Central or State Government. Therefore, proper maintenance of these structures was not carried out. Piezometers were not in the scope of work, however, nine Piezometers were constructed by the Mechanical Division to check water level of the particular vicinity.

The reply is not convincing as the Department has failed to maintain constructed recharging structures. Due to lack of this, all the recharging structures were deteriorating. Thus, negligence on the part of the Department defeated the purpose of the recharging the ground water.

Conclusion: *The Minor Hypothesis is mostly true. It was observed that there was a deficit between ground water extraction and artificial recharging. Artificial recharging and aquifer mapping for long-term sustainability of local ground water resources was not done by the PHED. Recharging structures were also not properly maintained by the PHED.*

6.5 Minor Hypothesis No-22: Provision of rainwater harvesting has not been implemented properly in Kshipra River Watershed.

Rainwater harvesting is a system by which the rainwater that collects on the roofs and the area around the buildings is directed into open wells through a filter tank or into a percolation chamber, built specifically for this purpose. Rainwater is collected directly or recharged into the ground to improve ground water storage.

The UDHD is responsible for the implementation of rainwater harvesting policies in the municipal areas. The UDHD mainly undertakes the rainwater harvesting works by constructing soak pits and roof top water harvesting, *etc*.

6.5.1 Non-compliance of provision of rainwater harvesting by the ULBs

Though provisions for rainwater harvesting were existing, but same were not being implemented properly by the ULBs.

As per Bye-laws of the ULBs, construction of rain water harvesting and adoption of water conservation measures are mandatory in all buildings. To ensure strict compliance to the *Bhumi Vikas Niyam* 2012, applicant is required to make a Security Deposit for installing roof top rainwater harvesting structure. Urban Administration Development Directorate (UADD) instructed (October 2009) ULBs to obtain the requisite security for roof water harvesting, as per build area from the land holder at the time of granting building permission, as detailed in **Table 6.19**.

Table 6.19: Security amount to be deposited according to area of buildings

S.N.	Build area of building	Security amount (in ₹)
1	From 140 to 200 sq. m.	7,000
2	Above 200 to 300 sq. m.	10,000
3	Above 300 to 400 sq. m.	12,000
4	More than 400 sq. m.	15,000

(Source: Urban Administration Development Directorate)

After execution of roof water harvesting by the owner and verification by the ULB, this amount will be reimbursed if the applicant installs the structure himself. Otherwise, the ULB installs the structure from the Security Deposit.

Details of building permission and installation of roof top rainwater harvesting systems are given in **Table 6.20**.

Table 6.20: Details of building permissions given during 2016-21 and installation of roof top rainwater harvesting systems

S.N.	Name of ULBs	No. of private buildings requiring roof top water harvesting	No. of buildings where roof top water harvesting executed	No. of buildings where roof top water harvesting not executed	Amount of Security Deposit with Department (₹ in lakh)
1	Indore	5,232	3,029	2,203	683.37
2	Ujjain	1,448	29	1,419	151.09
3	Dewas	452	50	402	39.53
4	Mahidpur	12	0	12	1.90
5	Sanwer	8	0	8	0.64
6	Alot	56	0	56	5.92
Total		**7,208**	**3,108**	**4,100**	**882.45**

(Source: Selected ULBs)

From **Table 6.20,** it could be seen that out of total 7,208 building permissions given in six ULBs, roof water harvesting systems were installed only in 3,108 buildings (43 *per cent)* of total building permissions. Hence, all six ULBs failed to ensure compliance of roof water harvesting system in their respective ULBs.

Further, Security Deposits amounting to ₹ 882.45 lakh was not utilized by ULBs for construction of roof top rainwater harvesting as provided in Madhya Pradesh Bhumi Vikash Niyam, 2012.The concerning ULBs were unable to implement rainwater harvesting in all houses by making awareness drives nor had they constructed the system themselves from the retained amount of Security Deposits.

Conclusion: *The Minor Hypothesis is true. It was observed that less than five per cent households, except Indore, installed rooftop water harvesting facility in their buildings, thus, ULBs had failed to implement the provisions of rainwater harvesting.*

6.6 Recommendations

Audit recommends that:

- CGWB may encourage the industries to obtain NOC before extracting groundwater and may formulate a mechanism for control of groundwater extraction.
- CGWB/PHED/PRIs/ULBs may emphasize on artificial recharging and water shed management and Forest Department may develop structures for soil water conservation.
- PHED/CGWB may develop the plans for groundwater recharge on the basis of regular aquifer mapping works.
- ULBs may ensure the implementation of Roof Top Rainwater Harvesting.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7 CHAPTER

Conclusions and Recommendations

7.1 Conclusion

Audit set out to verify the underlying causes behind the decline in quality and quantity of environmental flow of Kshipra, once a perennial river. This was done through testing and validation of pre-conceived hypotheses. Audit conclusions, mapped to the hypotheses are detailed below:

Major Hypothesis	Sub-major Hypothesis	Conclusion
Kshipra River has remained polluted even after multiple interventions of the State Agencies.	Untreated sewage from ULBs is merging in Kshipra River.	➢ STPs had not been constructed by the ULBs, keeping in view future demands. Sewerage network did not cover the entire geographical area. Sewerage network and STP related works could not be completed as per timelines. ULBs did not have a sound system for disposal of faecal sludge. ➢ STPs are working on older technologies and provision for reuse of treated effluents was also not created by the ULBs. ➢ STPs were either operating without CTO from MPPCB or compliance to consent conditions were not being followed by STPs.
	Treatment of Industrial waste is inadequate.	➢ MPPCB belatedly granted consent to industries. Further, industries were operating without consent and no action had been taken by the Board against such industries. selected industries were not submitting online discharge monitoring report/monthly testing report to MPPCB. ➢ Industries were either running without ETPs or were not equipped with alternative source of power. CETPs were not available in Dewas and Ujjain. Proper mechanism for ensuring compliance to Zero Liquid Discharge status was not available and only four *per cent* of the selected Industries were equipped with water meters. ➢ There was deficient action against industries even though industries violated provisions of the Water Act. Parameters of Fe, Cd, Ni, Pb were beyond the permissible limit in the ground water of Dewas industrial area, but action on defaulting industries was not taken.
	Water Quality of Kshipra River and its tributaries has been adversely affected due to Pollution at Riverbanks.	➢ Guidelines regarding regulations in Flood Plain Zone (FPZ) were not issued by Nagar Nigams and encroachments were observed in the FPZ of Kahn and Kshipra Rivers. River Front Development work was not executed properly. ➢ Planning for plantations was ineffective, plantation work was doubtful and reporting of plantations and selection of sites was not correct.

Major Hypothesis	Sub-major Hypothesis	Conclusion
The natural flow of water in Kshipra River has reduced due to improper management and over extraction of ground water in Kshipra sub-basin.	Water Flow in Kshipra River has reduced drastically.	➢ Provision for providing water in lean season into Kshipra River was made but not implemented. Thus, environmental flow in lean season could not be achieved as sufficient quantity of water was not released. The Government had completely deviated from the earlier aim of transforming Kshipra River into a perennial river by infusing Narmada water into Kshipra through the NKSL project.
	Flow of Kshipra River is affected due to decreasing ground water.	➢ NOC was not obtained by Industries from CGWB before extracting ground water. Further, water meters were not installed to monitor the actual ground water extraction. Also dependency on ground water in irrigation had increased due to lack of alternative arrangement of water for irrigation. ➢ CGWB had failed to form guidelines for seven overexploited blocks of Kshipra Basin. ➢ Arrangements for optimal utilisation of treated sewage water were not done. Artificial recharging and aquifer mapping for long-term sustainability of local ground water resources were not done by the PHED.

7.2 Summary of recommendations

Audit recommends that:

- ULBs may prepare City Sanitation Plan and develop appropriate Sewerage Network.
- ULBs may prepare Faecal Sludge and Septage Management Policy. They should also ensure utilisation of the full capacity of STPs and sufficient provisioning for reuse of treated effluents.
- MPPCB may formulate a plan for timely issuance of consents and develop a mechanism for ensuring that the industries do not operate without active consents. MPPCB should also ensure proper and adequate monitoring of industries through inspections.
- Responsibility for allowing industries to operate without consent and lack of monitoring/ inspections by the officers concerned may be fixed by MPPCB.
- MPPCB may ensure installation of ETPs and water meters by the industries and also ensure strict compliance with the Water Quality Monitoring Guidelines.
- ULBs may formulate guidelines for regulation of activities in the Flood Plain Zone and may address the issue of removal of encroachments.
- ULBs may formulate guidelines for cleaning of Ghats along Kshipra River and regulation of religious/customary activities on the banks of Rivers.
- The NKSL may be effectively utilised to provide water to Kshipra River in the lean season.
- ULBs and Forest Department may develop an effective mechanism for developing plantations alongside Kshipra River.

- Government may formulate strict policies/guidelines for extraction of ground water in consultation with CGWB and also take effective steps to recharge groundwater through synergy between ULBs, PRIs, Forest, PWD and PHE Departments.

Bhopal
The 16 June 2023

(PRIYA PARIKH)
Accountant General
(Audit II)
Madhya Pradesh

Countersigned

New Delhi
The 19 June 2023

(GIRISH CHANDRA MURMU)
Comptroller and Auditor General of India

APPENDICES

Appendix 2.1

(Reference: Paragraph 2.3.5.2)

Details of substandard execution of Pavement Quality Concrete in road work

S.N.	Location	Type of concrete	Acceptable mean compressive strength	Height of CC	crushing strength	Acceptable limit of core	Equivalent crushing strength
	1	2	3	4	5	6 (85% of 3)	7
1	Zone-7,Bhargavnaga	M:20	240	20	174.84	204	218.56
2	Zone-7, Shantinagar	M:20	240	16.5	161.56	204	201.95
3	Zone-7 Krishna Park	M:20	240	20.5	126.47	204	158.09
4	Zone-6, Vishnupura	M:20	240	20	131.66	204	164.57
5	Zone-5, KachBasti	M:20	240	17	154.23	204	192.79
6	Zone-6, Dasshera Maidan	M:20	240	28	156.52	204	196.65
7	Zone-7, Rashinagar main road	M:20	240	20	138.72	204	173.4
8	Zone-2, Mohanangar main road	M:20	240	21	180.84	204	226.05
9	Zone-1, Piplainaka main road	M:20	240	20	191.021	204	238.78
10	Cosmos (IN)	M:20	240	20	187.6	204	234.5
11	Alakhnanda	M:20	240	21	101.85	204	127.32
12	Mahashakti	M:20	240	22	175.69	204	219.61
13	32 Batalian	M:20	240	21	114.38	204	142.98
14	Nanakheda	M:20	240	21	178.66	204	223.33
15	SBI Colony	M:20	240	20.1	187.6	204	234.5
16	Ashok Nagar	M:20	240	21.5	178.25	204	222.81
17	Priti parisar	M:20	240	20.1	174.84	204	218.55
18	Triveni Hills	M:20	240	21	188.13	204	235.17
19	HariomVihar	M:20	240	19	171.9	204	214.9
20	MahanandaVihar	M:20	240	19.5	170.03	204	212.9
1	Zone-6, Neelangana Road	M:30	340	16	197.42	289	246.77
2	Zone-8, near Circuit House	M:30	340	20	181.17	289	226.46
3	GadhKalika	M:30	340	20.5	254.29	289	317.86
4	Vasant Vihar	M:30	340	21.1	249.84	289	312.3
5	Mahankal Vanijya	M:30	340	22	205.51	289	256.51
6	Mahabir Bagh	M:30	340	22	251.05	289	313.81
7	ISCON Temple (1st Stage)	M:30	340	21	249.54	289	311.93
8	Kothi Road (1st Stage)	M:30	340	20.9	258.44	289	323.05
9	Kothi Road (2nd Stage)	M:30	340	20.7	255.55	289	319.44
10	ISCON Temple (2nd Stage)	M:30	340	20.6	260.88	289	326.1
11	MahavirBagh (1st Stage)	M:30	340	25	259.7	289	324.6
12	MahavirBagh (2nd Stage)	M:30	340	18.7	248.2	289	310.03
13	Mahananda Nagar (Basket ballvihar) (1st Stage)	M:30	340	19	258.1	289	322.6
14	Mahananda Nagar (Basket ballvihar) (2nd Stage)	M:30	340	20	250.4	289	313

Appendix 2.2

(Reference: Paragraph 2.3.6.1)

Extra Cost of Work due to change in location of STP

S.N.	Work to be executed				
	As per Tender BOQ (A)				
	DI k9 Raising main	**Quantity**	**Rate**	**Unit**	**Amount in ₹**
1	300 mm dia	1,100	3,664	metre	40,30,400
2	350 mm dia	800	4,860	metre	38,88,000
Total (A)					**79,18,400**
As Per Actual execution (B)					
	DI K7 pipe				
3	300 mm dia	546	3,102	metre	16,93,692
4	600 mm dia	8,796	8,335	metre	7,33,14,660
					Excavation [1]
5	0 to 1.5 m Depth (Soil)	22,954.55	129	Cu.M.	29,61,137
6	1.5 m to 3.0 m Depth (Soil)	3,176.33	134	Cu.M.	4,25,628
7	Filling excavated earth in tranches	23,422.67	25	Cu.M.	5,85,567
Total (B)					**7,89,80,684**
Difference (B- A)					**7,89,80,684-79,18,400 = 7,10,62,284**
Extra cost including 16.58 *per cent* premium					**8,28,44,411**

[1] As per SLTC decision in 141st meeting, payment of excavation of filling of road restoration was not payable in BOQ item.

Appendix 2.3

(Reference: Paragraph 2.3.6.7)

Details of incorrect application of PHED 2016 USR instead of UADD USR of 2012

S.N.	Item	Rate of applied	Rate applicable as per UADD/ PHED SOR		Difference	Quantity	percentage	Amount in ₹
	Laying jointing of DWS pipe	**Rate**	**Item No.**	**Rate**				
1	250 mm supply	968	12.2.1.5	767	201	5,940	50	5,96,970
2	On Laying jointing					3,691.5	30	2,22,597.5
3	On Testing					409.2	10	8,224.92
4	300 mm supply	1,410	14.1.7	1,287	123	7,452	50	4,58,298
5	On laying jointing					3,518.7	30	1,29,840
6	On testing					221.5	10	2,724.45
Total								**14,18,655**
Add 9.383285 *per cent* (tender premium)								**1,33,116.4**
Excess Payment								**15,51,771**

Appendix 3.1

(Reference: Paragraph 3.6.2)

Details of Water Quality Parameters at sampled locations

S. N.	Sampling Location	Acceptable limit of DO (mg/l)	DO (mg/l)	Acceptable limit of COD (mg/l)	COD (mg/l)	Acceptable limit of Nitrite (mg/l)	Nitrite (mg/l)	Acceptable limit BOD (mg/l)	BOD (mg/l)	Acceptable limit Phosphate (mg/l)	Phosphate (mg/l)	Acceptable limit of FC (MPN/ 100ml)	FC Count (MPN/ 100ml)
1	Ramghat Kshipra River, Ujjain	> 3 mg/l	11.9	< 250 mg/l	400	< 1mg/l	14.3	< 3 mg/l	32.5	<0.1 mg/l	1.4	< 500	40
2	83 MLD STP Nagar Nigam, Ujjain	> 3 mg/l	7.4	< 250 mg/l	328	< 1mg/l	18.7	< 3 mg/l	17.4	<0.1 mg/l	17.0	< 500	230
3	Gaughat, Kshipra River, Ujjain	> 3 mg/l	10.7	< 250 mg/l	36	< 1mg/l	20.7	< 3 mg/l	26.1	<0.1 mg/l	2.3	< 500	230
4	Sanwer Kahn River, After Town	> 3 mg/l	1.2	< 250 mg/l	183	< 1mg/l	21.3	< 3 mg/l	0.9	<0.1 mg/l	21.0	< 500	Less than 20
5	Near Ram Mandir, Mahidpur, Kshipra River, Ujjain	> 3 mg/l	11.3	< 250 mg/l	53	< 1mg/l	11.0	< 3 mg/l	25.4	<0.1 mg/l	29.0	< 500	40
6	Kshipra River Sukhliya Village, Dewas	> 3 mg/l	3.9	< 250 mg/l	307	< 1mg/l	9.3	< 3 mg/l	1.3	<0.1 mg/l	32.3	< 500	1300
7	Confluence of Kahn and Saraswati rivers, Indore	> 3 mg/l	3.8	< 250 mg/l	102	< 1mg/l	9.3	< 3 mg/l	9.0	<0.1 mg/l	135.0	< 500	220
8	Kahn River near zoo, Indore	> 3 mg/l	7.2	< 250 mg/l	184	< 1mg/l	12.0	< 3 mg/l	18.3	<0.1 mg/l	33.0	< 500	130
9	Siddhwat, Kshipra river, Ujjain	> 3 mg/l	9.4	< 250 mg/l	136	< 1mg/l	3.7	< 3 mg/l	24.9	<0.1 mg/l	130.0	< 500	Less than 20
10	78 MLD Outlet, Nagar Nigam, Indore	> 3 mg/l	0.2	< 250 mg/l	165	< 1mg/l	10.3	< 3 mg/l	1.1	<0.1 mg/l	147.0	< 500	20
11	12 MLD Outlet, Nagar Nigam, Indore	> 3 mg/l	0.3	< 250 mg/l	190	< 1mg/l	14.0	< 3 mg/l	1.4	<0.1 mg/l	137.3	< 500	800
12	245 MLD Outlet, Nagar Nigam, Indore	> 3 mg/l	5.0	< 250 mg/l	56	< 1mg/l	3.3	< 3 mg/l	6.8	<0.1 mg/l	83.0	< 500	300

S. N.	Sampling Location	Acceptable limit of DO (mg/l)	DO (mg/l)	Acceptable limit of COD (mg/l)	COD (mg/l)	Acceptable limit of Nitrite (mg/l)	Nitrite (mg/l)	Acceptable limit BOD (mg/l)	BOD (mg/l)	Acceptable limit Phosphate (mg/l)	Phosphate (mg/l)	Acceptable limit of FC (MPN/ 100ml)	FC Count (MPN/ 100ml)
13	**35 MLD Outlet, Nagar Nigam, Indore**	> 3 mg/l	4.1	< 250 mg/l	12	< 1mg/l	10.0	< 3 mg/l	8.9	<0.1 mg/l	42.3	< 500	230
14	4 MLD CETP Outlet, Nagar Nigam, Indore	> 3 mg/l	3.0	< 250 mg/l	222	< 1mg/l	10.0	< 3 mg/l	8.6	<0.1 mg/l	7.0	< 500	60
15	4 MLD CETP Inlet, Nagar Nigam, Indore	> 3 mg/l	0.0	< 250 mg/l	1227	< 1mg/l	7.7	< 3 mg/l	1.4	<0.1 mg/l	84.7	< 500	210
16	22 MLD STP Outlet, Nagar Nigam, Dewas	> 3 mg/l	7.3	< 250 mg/l	34	< 1mg/l	13.0	< 3 mg/l	18.5	<0.1 mg/l	124.7	< 500	20
17	Mangalnath ghat, Kshipra river, Ujjain	> 3 mg/l	10.0	< 250 mg/l	108	< 1mg/l	11.7	< 3 mg/l	26	<0.1 mg/l	120.3	< 500	Less than 20
18	After Confluence of Kahn and Kshipra Rivers, Ujjain	> 3 mg/l	7.0	< 250 mg/l	53	< 1mg/l	13.3	< 3 mg/l	17.2	<0.1 mg/l	75.3	< 500	Less than 20
19	Hawankhedi after confluence of Nagdhaman Nalla and Kshipra River, Dewas	> 3 mg/l	10.3	< 250 mg/l	58	< 1mg/l	12.7	< 3 mg/l	27.6	<0.1 mg/l	42.0	< 500	Less than 20
20	Kabitkhedi, Kahn River, Indore	> 3 mg/l	0.1	< 250 mg/l	104	< 1mg/l	15.0	< 3 mg/l	2	<0.1 mg/l	55.0	< 500	230
21	Dhediya, Kshipra River, Ujjain	> 3 mg/l	7.5	< 250 mg/l	111	< 1mg/l	16.0	< 3 mg/l	18	<0.1 mg/l	9.0	< 500	40

Appendix 4.1

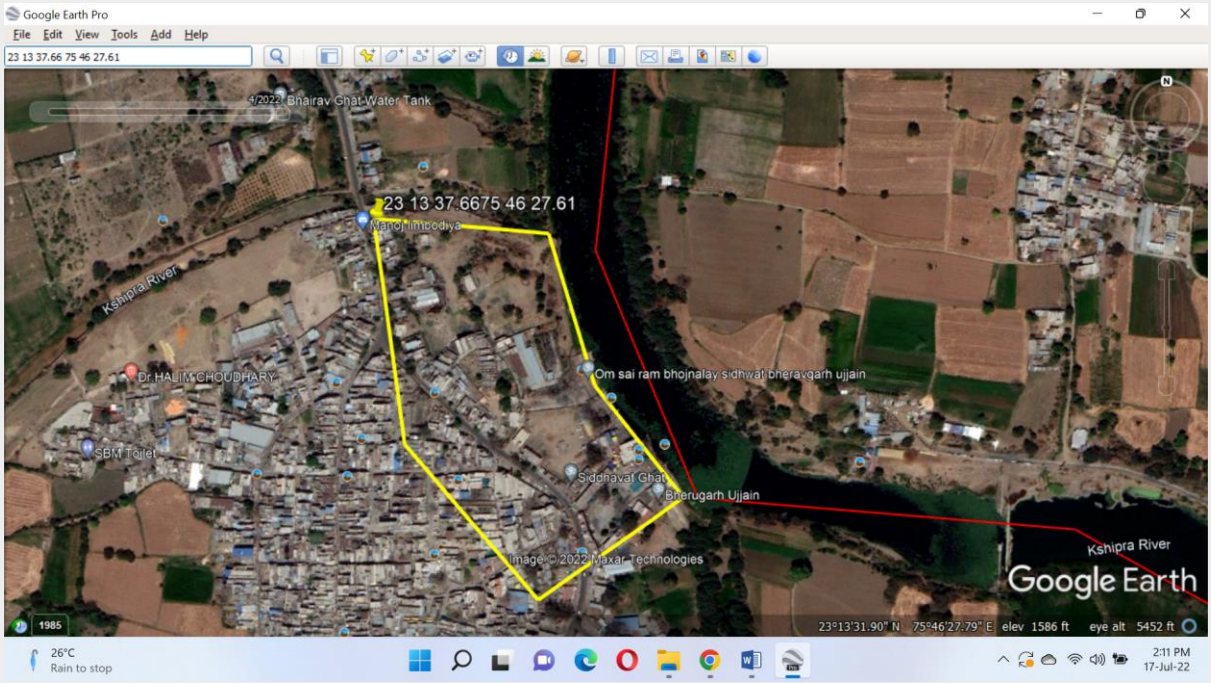
(Reference: Paragraph 4.2.2)

Details regarding constructions in Flood Plain Zone of Kshipra and Kahn River

1) Left Bank of Kshipra River

Start Point 23°13'37.66" 75°46'27.61"

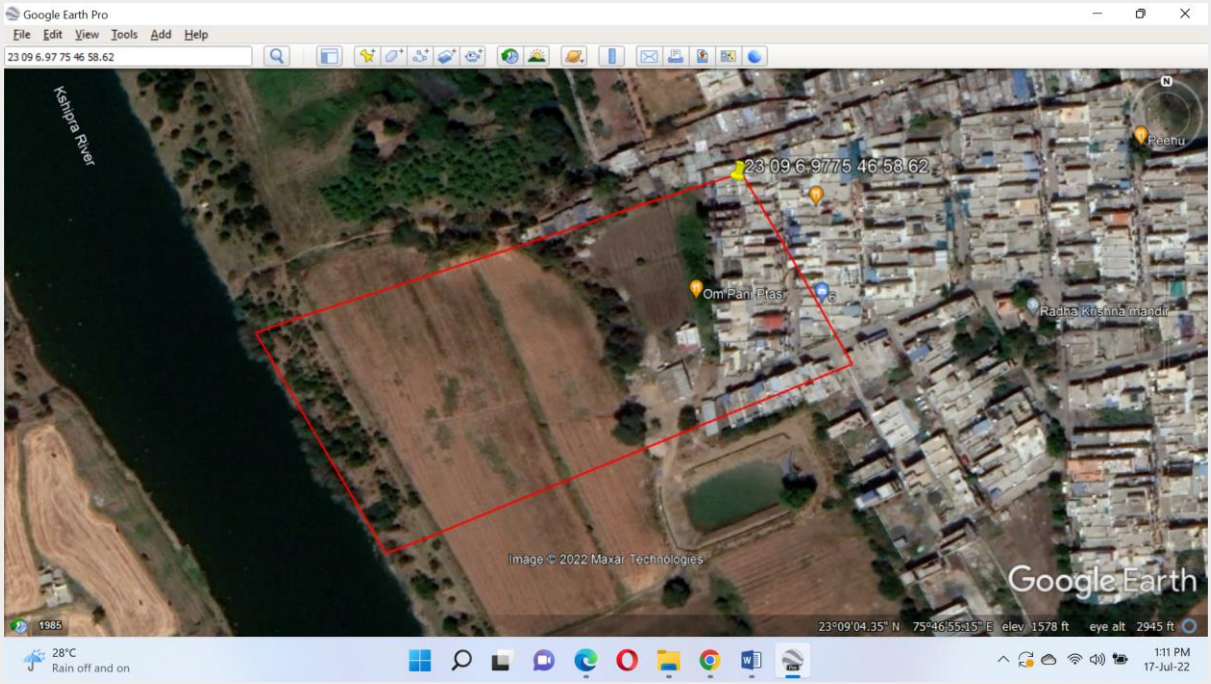
End Point 23°13'23.94" 75°46'34.15"



2) Right Bank of the Kshipra River

Start Point 23°09'06.97" 75°46'58.62"

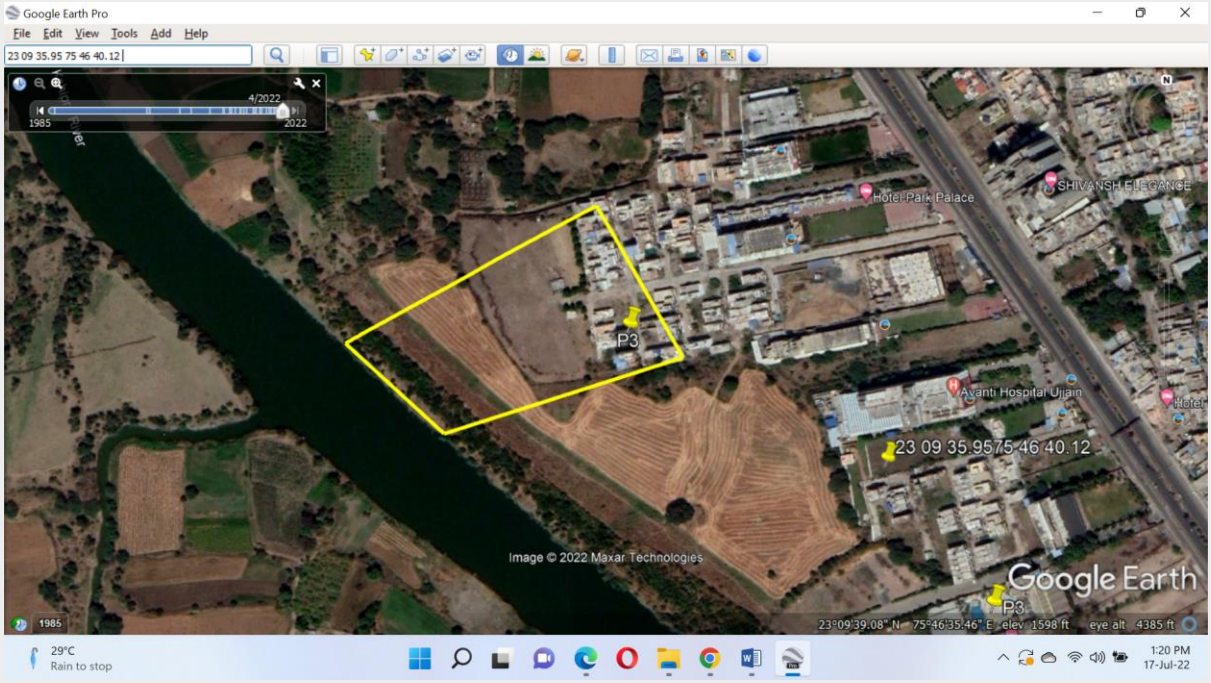
End Point 23°09'04.69" 75°47'00.25"



3) Right Bank of the Kshipra River

Start Point 23°09'42.61" 75°46'31.75"

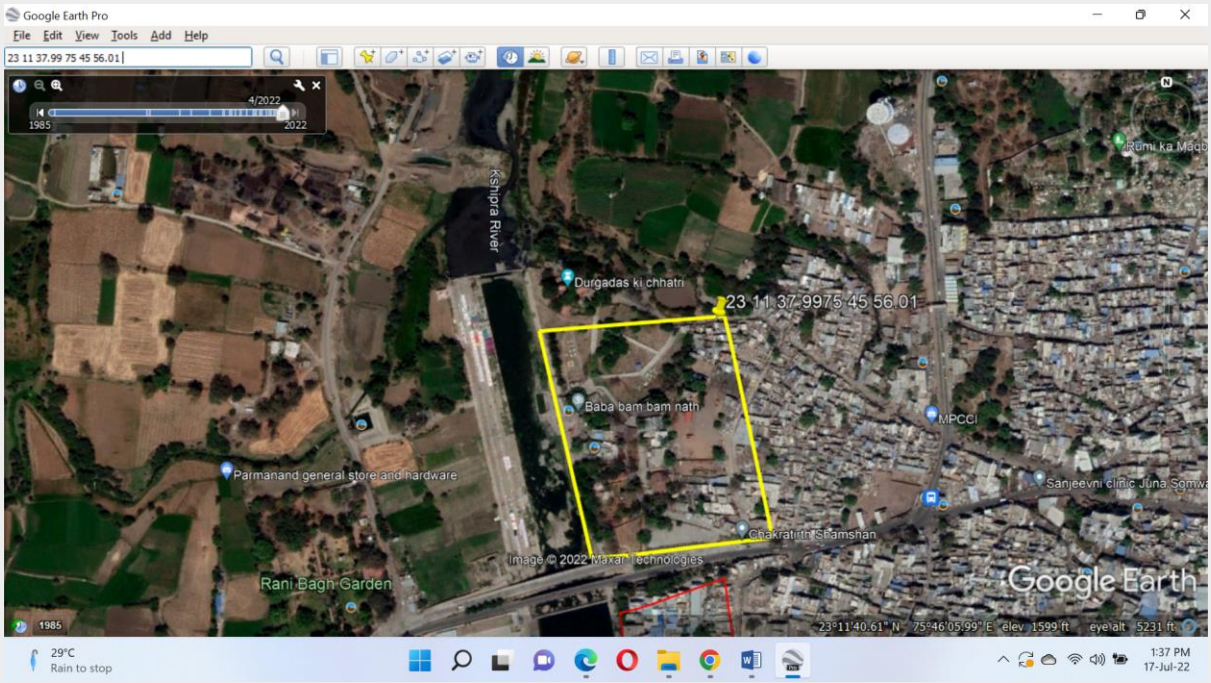
End Pont 23°09'38.66" 75°46'34.53"



4) Right Bank of the Kshipra River

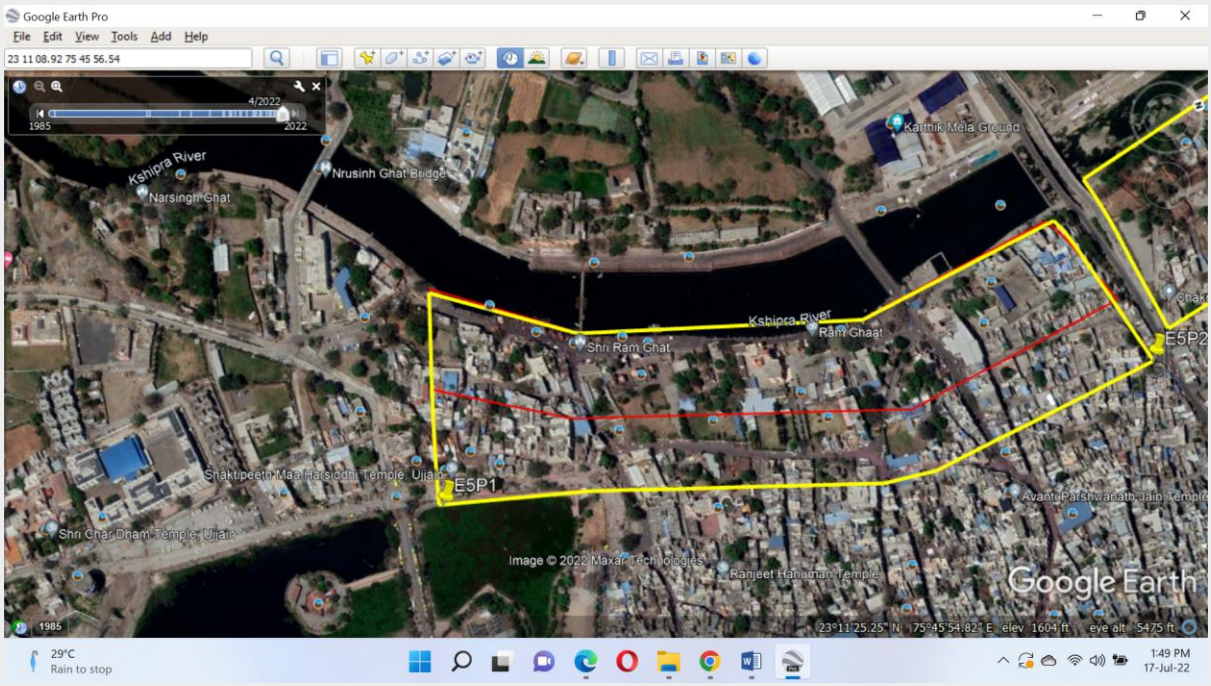
Start Point 23°11'37.99" 75°45'56.01"

End Point 23°11'30.63" 75°45'58.39"



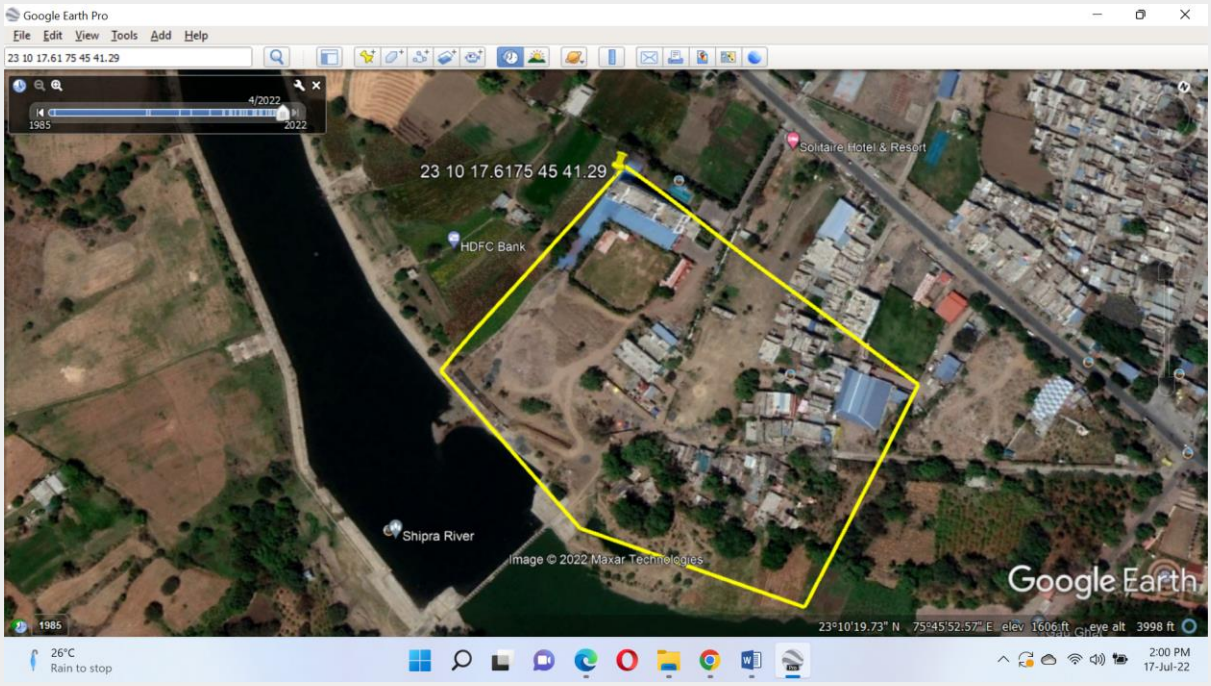
5) Right Bank of Kshipra River

Start Point	23°11'03.37"	75°45'54.71"
End Point	23°11'29.66"	75°45'59.13"



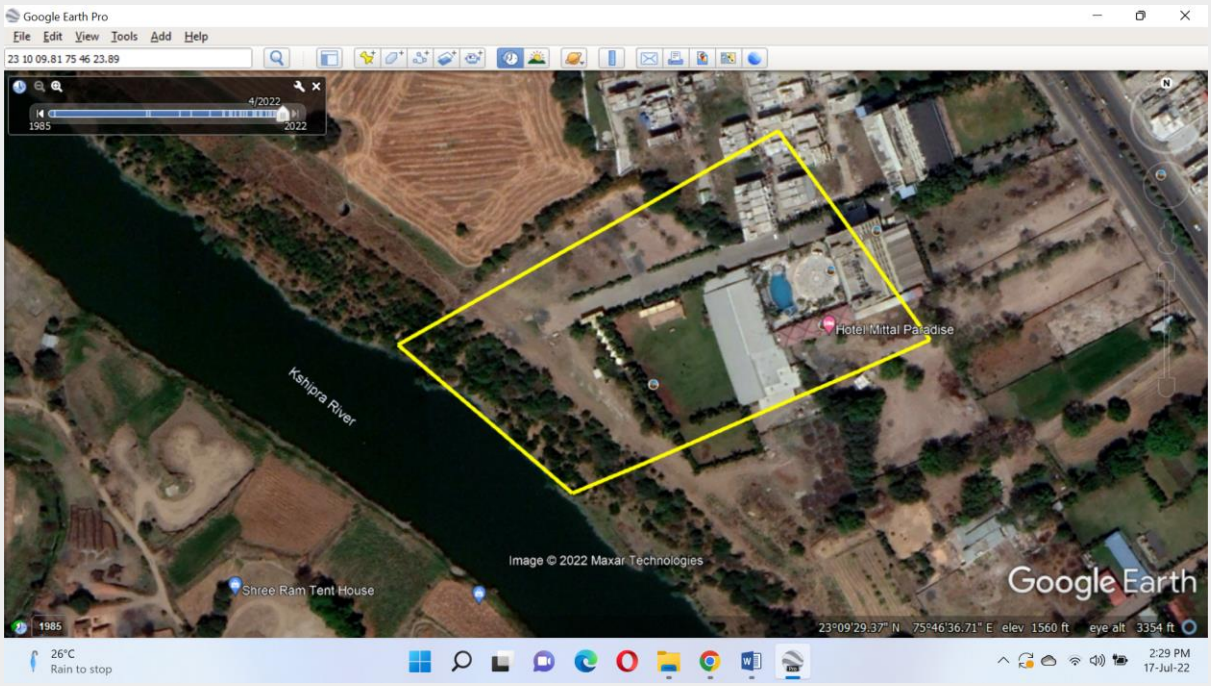
6) Right Bank of the Kshipra River

Start Point	23°10'17.61"	75°45'41.29"
End Point	23°10'16.69"	75°45'50.65"



7) Right Bank of Kshipra River

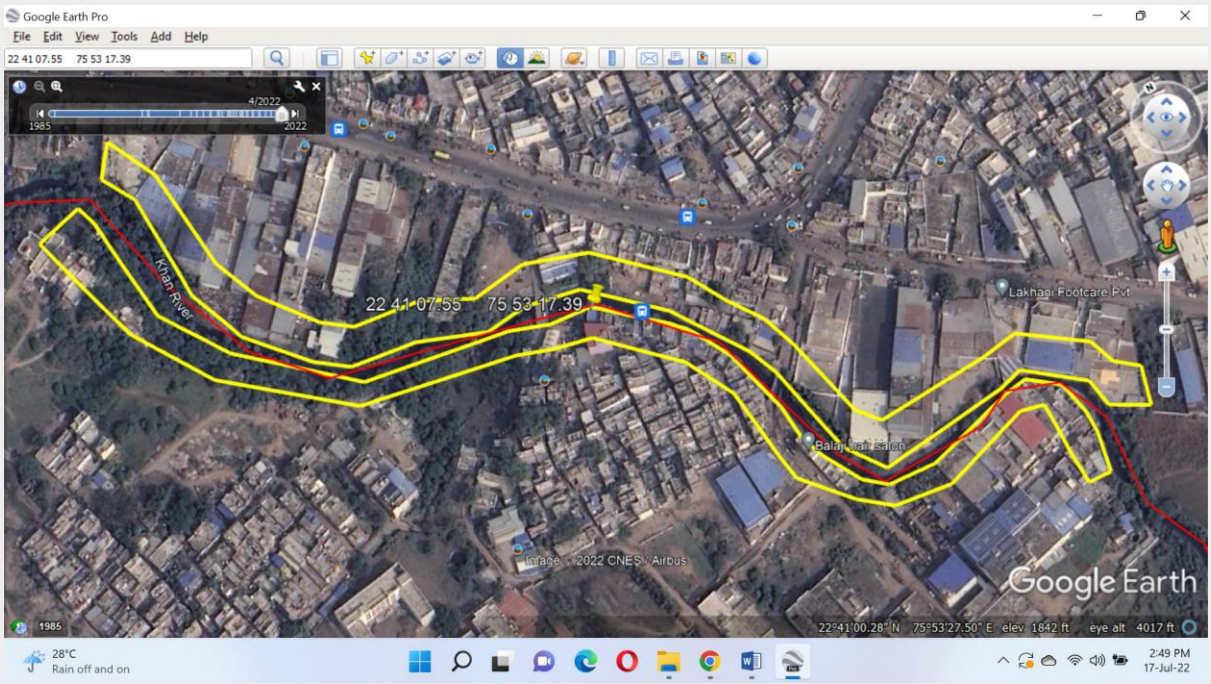
Start Point	23°09'31.39"	75°46'45.27"
End Point	23°09'34.76"	75°46'42.67"



Encroachments in Indore

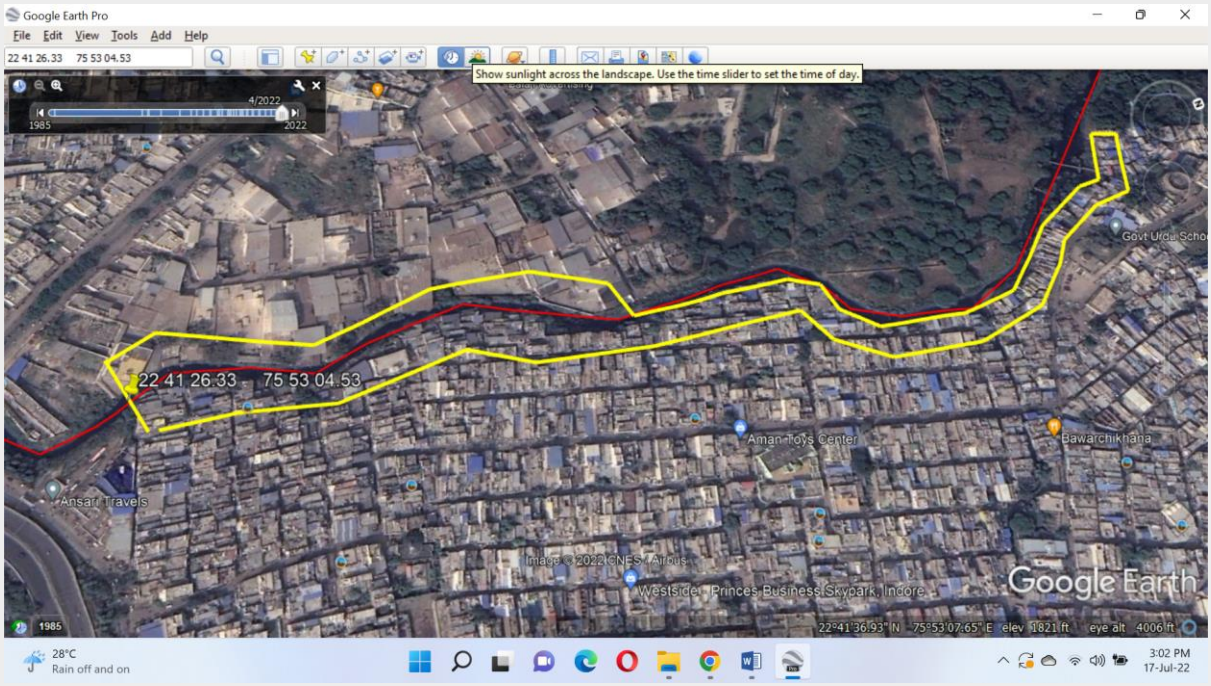
8) Both Sides of Kahn River

Start Point	22°40'59.74"	75°53'26.52"
End Point	22°41'14.68"	75°53'08.70"



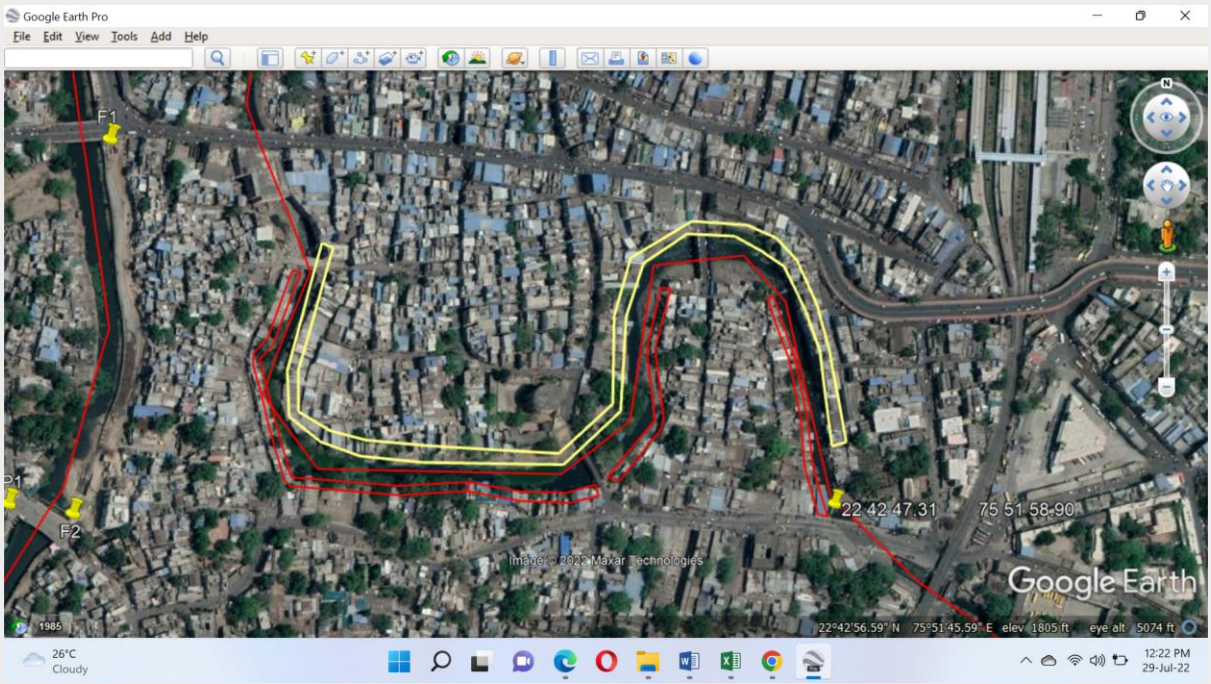
9) On both the sides of the Banks and mostly on the Right Bank of Kahn River

Start Point	22°41'26.33"	75°53'04.53"
End Point	22°41'51.32"	75°53'6.13"



10) On left side of the Kahn Riverbank

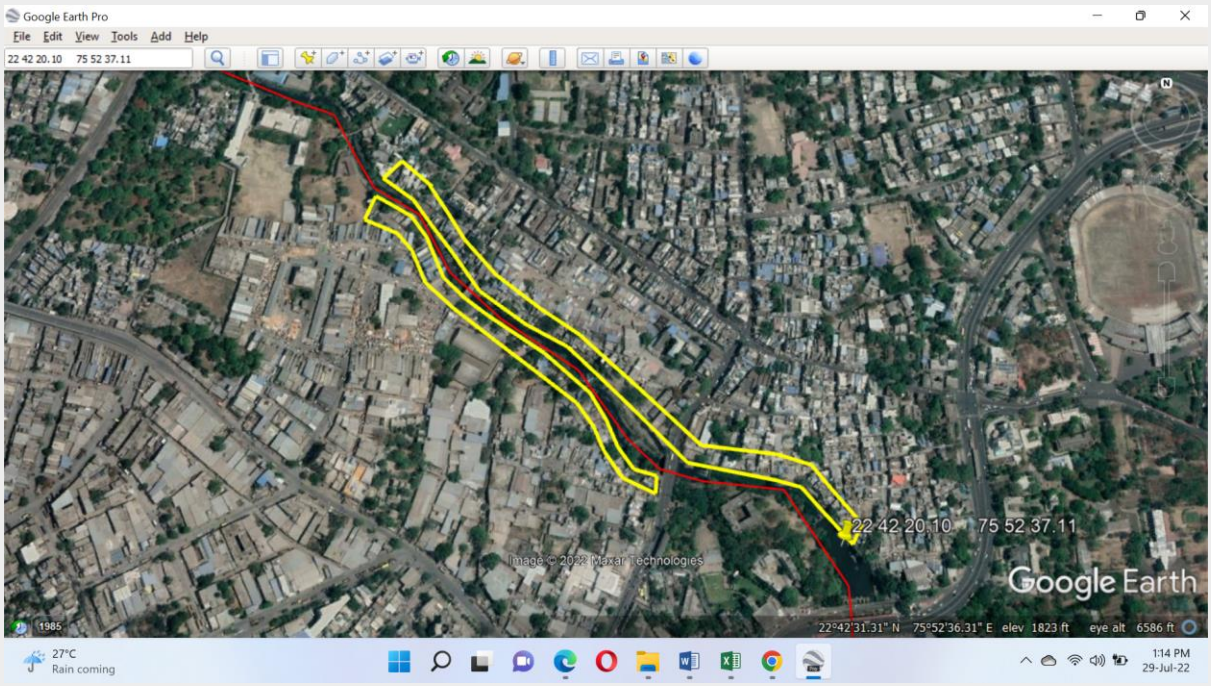
Start Point	22°42'54.82"	75°51'41.04"
End Point	22°42'01.53"	75°52'48.42"



11) On both the sides of the Banks and mostly on the Right Bank of Kahn River

Start Point 22°42'20.10" 75°52'37.11"

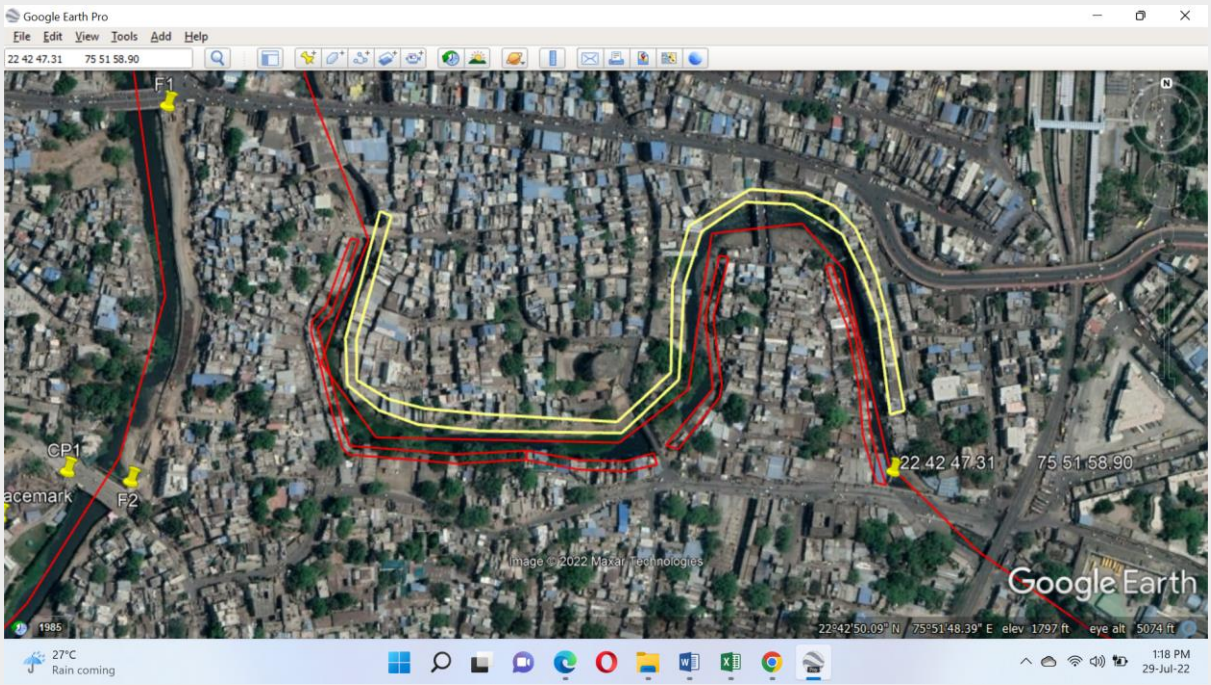
End Point 22°42'36.52" 75°52'14.11"



12) On both sides of Bank of River Kahn

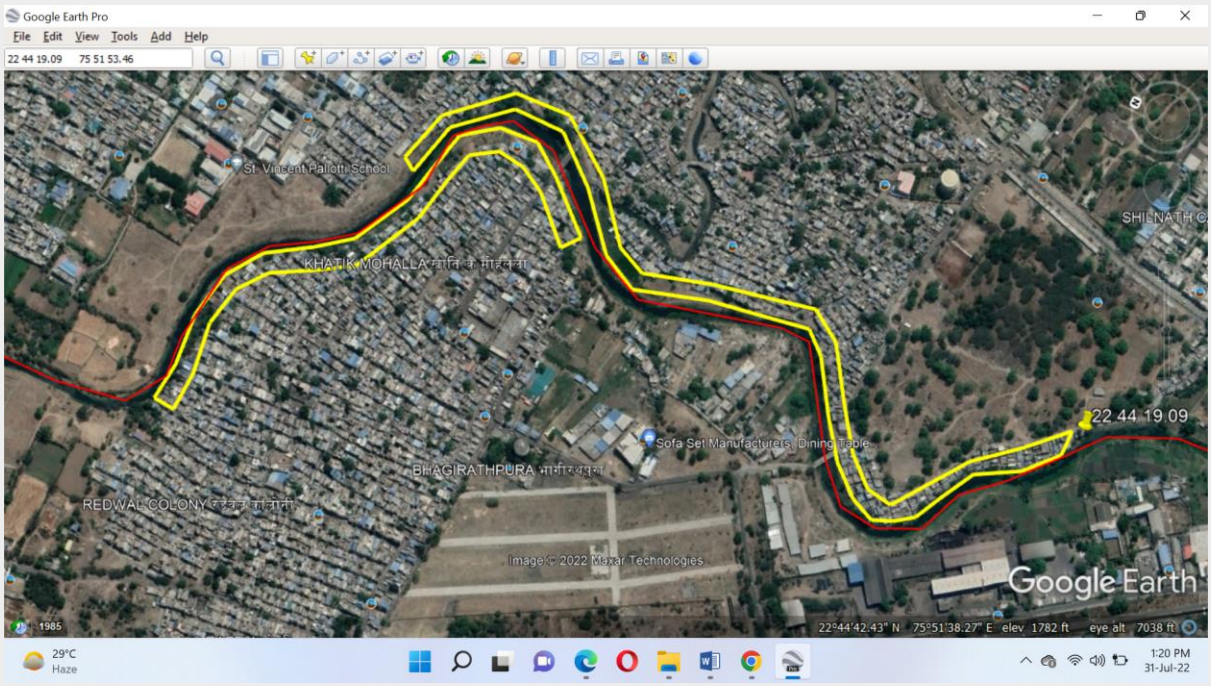
Start Point 22°42'47.31" 75°51'58.90"

End Point 22°42'54.88" 75°51'41.19"



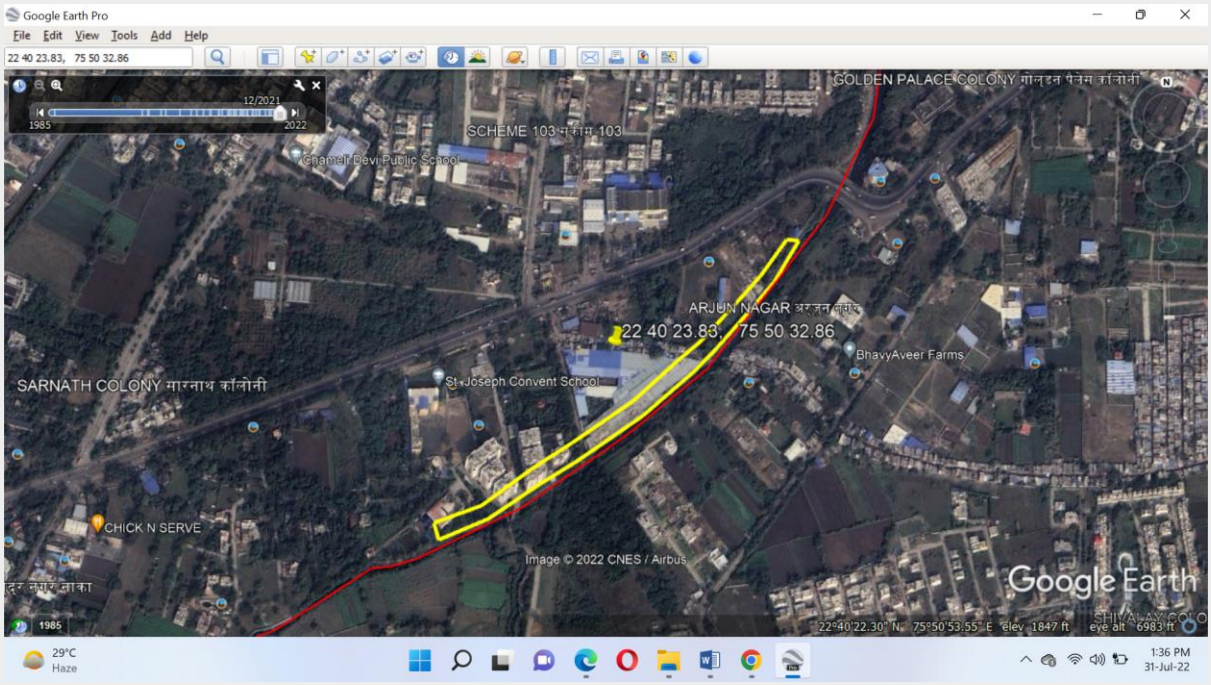
13) Both sides of Kahn River

Start point	22°45'01.39"	75°51'33.76"
End point	22°44'19.09"	75°51'53.46"



14) On Left Bank of Saraswati River

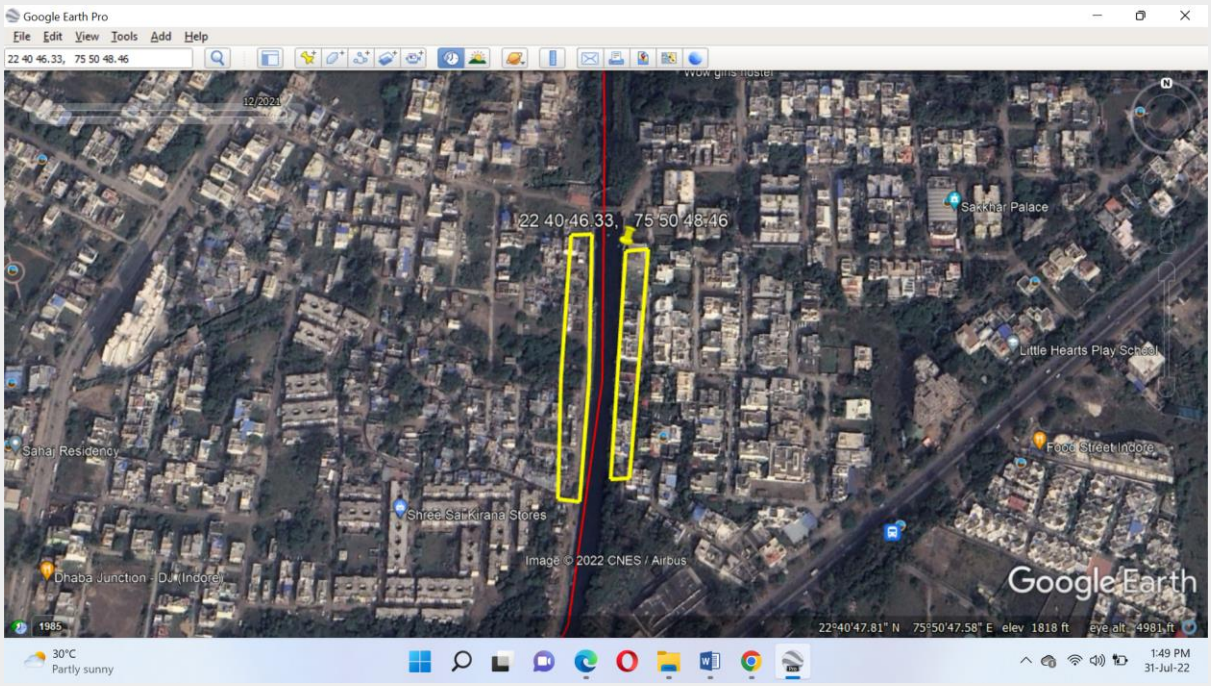
Start Point	22°40'29.10"	75°50'42.47"
End Point	22°40'14.76"	75°50'23.70"



15) On both sides of Saraswati River

Start point 22°40'46.33" 75°50'48.46"

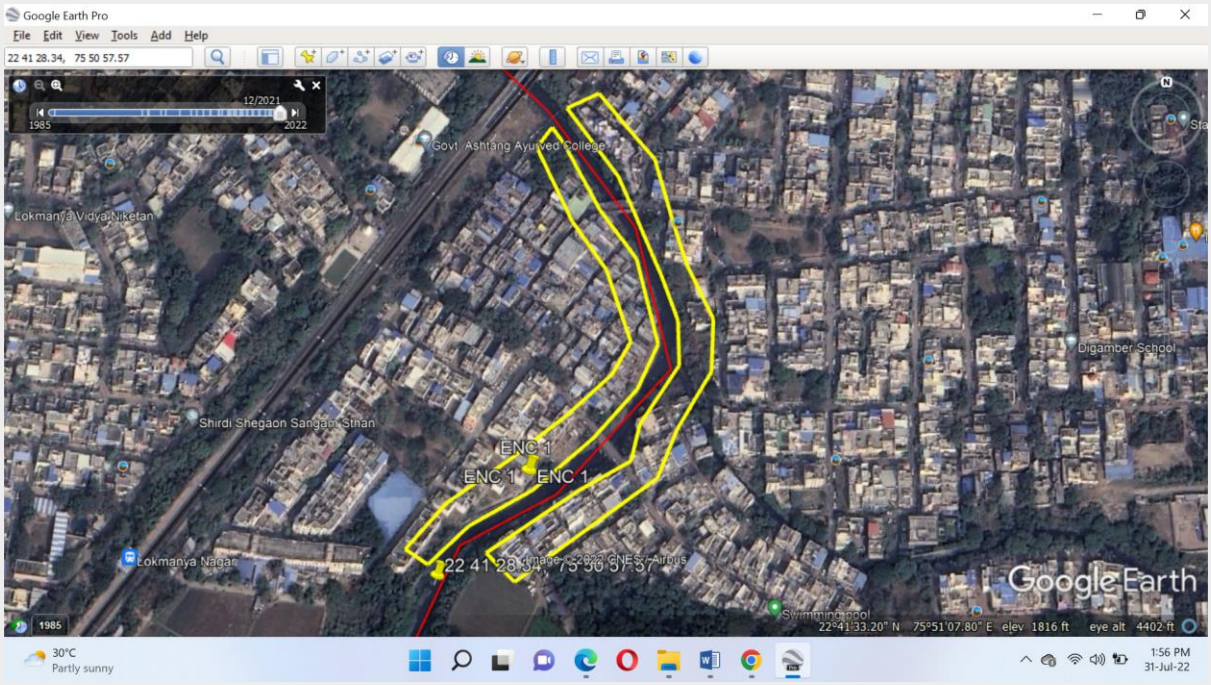
End point 22°40'38.73" 75°50'47.23"



16) On both sides of Saraswati River

Start Point 22°41'40.04" 75°51'0.88"

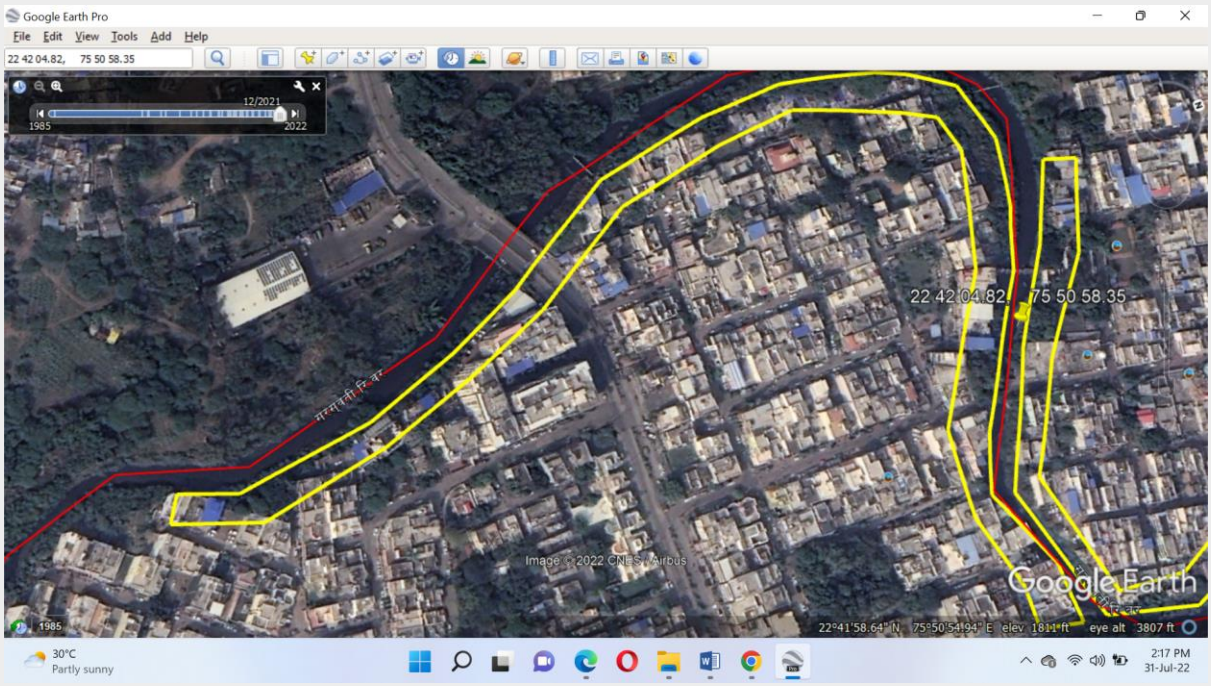
End point 22°41'28.34" 75°50'57.57"



17) On Right side of Saraswati River

Start Point 22°41'48.60" 75°50'55.54"

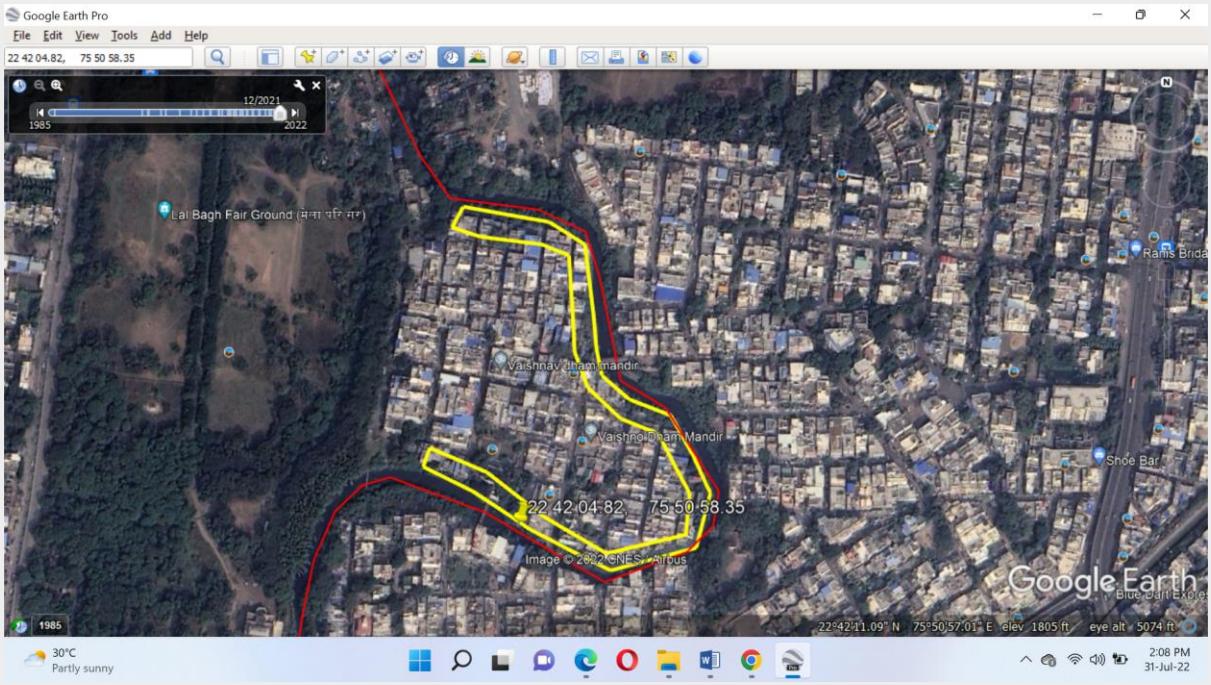
End Point 22°42'03.65" 75°51'03.94"



18) On Left Side of Saraswati River

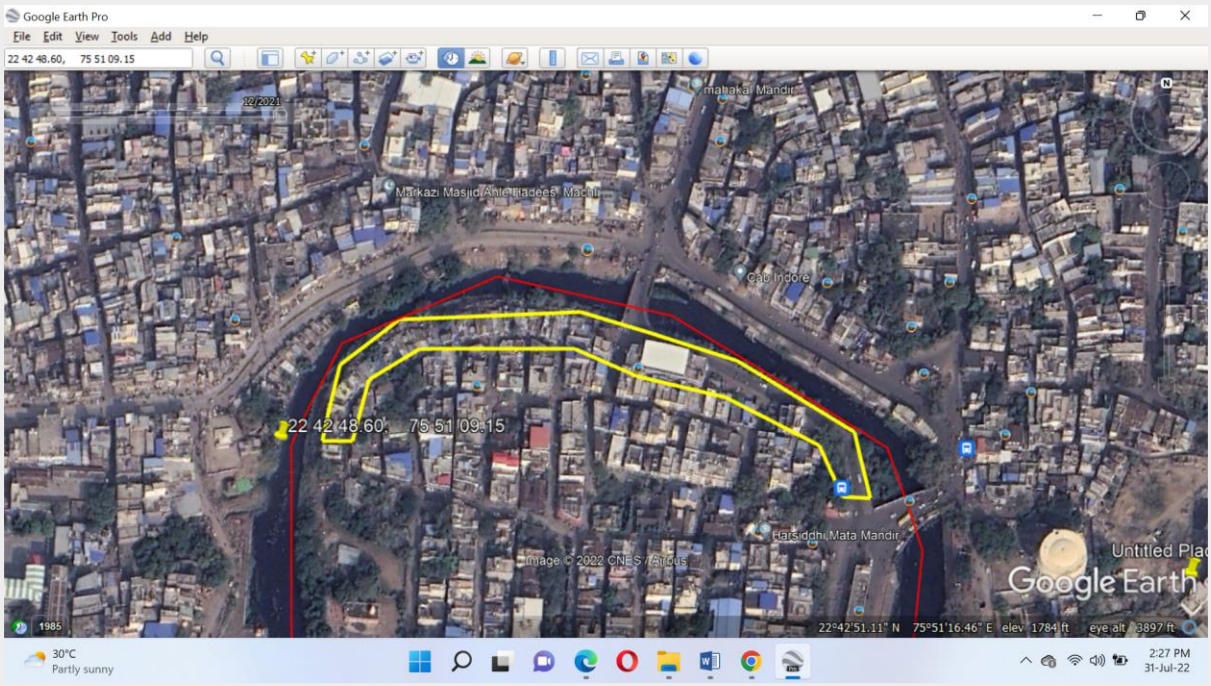
Start Point 22°42'14.26" 75°50'56.19"

End Point 22°42'06.65" 75°50'55.10"



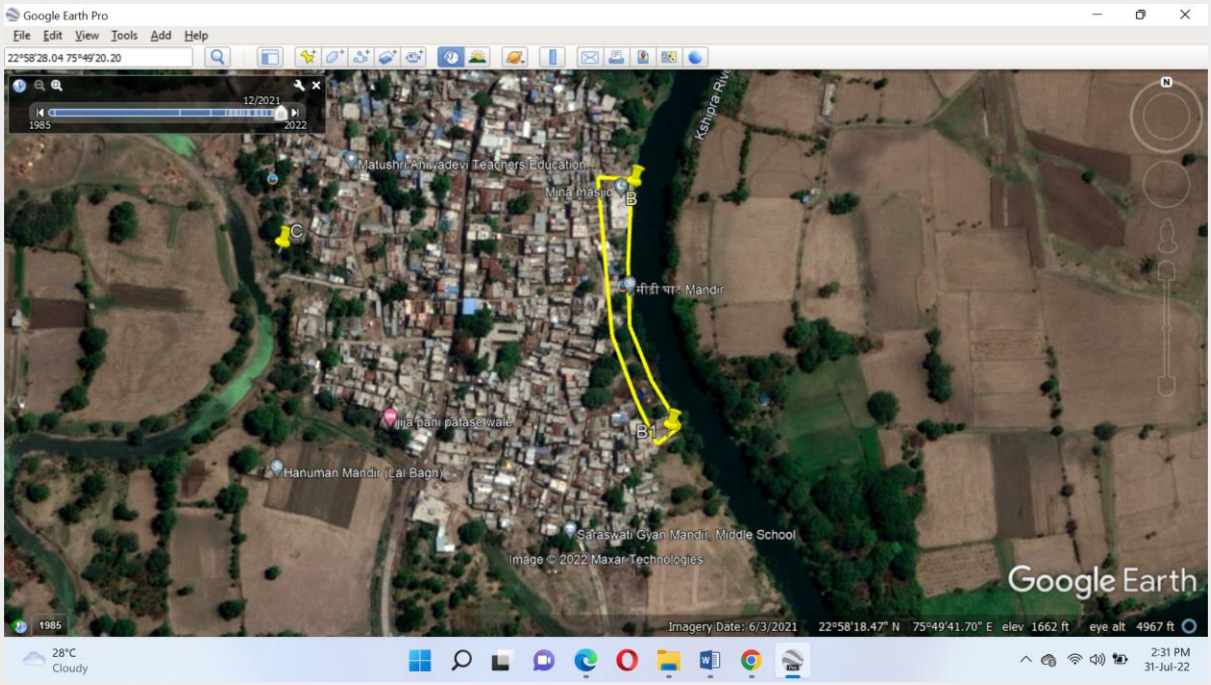
19) On Right Bank of Sarswati River

Start Point	22°42'48.60"	75°51'09.15"
End Point	22°42'47.63"	75°51'21.80"



20) On Left Bank of Kahn River

Start Point	22°58'16.88"	75°49'44.99"
End Point	22°58'24.40"	75°49'43.49"



Appendix 4.2

(Reference: Paragraph 4.2.4)

Details of plantations by Indore and Ujjain ULBs

S.N.	Name of Place	Area in Hectare	Distance (in km)	Plantations required	GPS Co-ordinates
Ujjain North					
1	Bhairav Garh pul to Holkar Bagh	2.00	0.61	5,000	N 23^0 13′ 03″ E 75^0 46′ 20″
2	Nallah to Vikrant Bhairav Pul	0.60	0.20	2,000	N 23^0 12′ 59″ E 75^0 46′ 04″
3	Maunibaba Ashram to Bhairav Garh Pul	3.50	1.13	7,000	N 23^0 13′ 01″ E 75^0 46′ 40″
4	Bharthari Gufa to Okhleshavar Ghat	6.00	2.00	9,000	N 23^0 12′ 09″ E 75^0 45′ 56″
5	Ranjit Hanuman to Vikrant Bhairav	8.40	2.80	10,000	N 23^0 12′ 50″ E 75^0 45′ 44″
6	Kaal Bhairav Pul to Bhairav Garh Pul	1.80	0.60	3,000	N 23^0 13′ 05″ E 75^0 46′ 13″
7	Bhairavgarh Pul to Angareshwar Mahadev	4.50	1.50	4,000	N 23^0 13′ 24″ E 75^0 46′ 53″
8	Angareshwar Mahadev to Aabu Khana	9.00	3.00	6,000	N 23^0 14′ 43″ E 75^0 47′ 01″
9	Sadumata Bawdi	2.00	1.00	4,000	No Co-ordinates provided
Total		**37.80**	**12.84**	**50,000**	
Ujjain South					
1	Nanakheda -1 Prashanti Dham Goyal Khurd to Shanti Palace Bridge	4.86	1.62	11,000	N 23^0 08′ 33″ E 75^0 47′ 01″ N 23^0 09′ 18″ E 75^0 46′ 46″
2	Nanakheda - 2 Shanti Palace Bridge to Vikram Patel khet (khajoor tak)	3.48	0.87	8,000	N 23^0 09′ 20″ E 75^0 46′ 45″ N 23^0 09′ 40″ E 75^0 46′ 25″
3	Nanakheda – 3 Vikram Patel Khet to Kundan Mali ke Bagiche	10.00	1.00	15,000	N 23^0 09′ 41″ E 75^0 46′ 25″ N 23^0 10′ 00″ E 75^0 46′ 17″
4	Vakankar Bridge to Karkraj Mandir	8.25	2.75	8,000	N 23^0 10′ 07″ E 75^0 46′ 18″ N 23^0 10′ 50″ E 75^0 45′ 29″
5	Triveni Bridge to Prashanti Dham Goyal Khurd	7.30	2.43	8,000	N 23^0 07′ 50″ E 75^0 47′ 43″ N 23^0 08′ 29″ E 75^0 46′ 58″
Total		**33.89**	**8.67**	**50,000**	
Indore New Plantation					
1	Behind Laal Bhag Vaishno Devi Mandir (Saraswati)	1.25 ha		9,000	22° 42' 05.22" 75° 50' 52.70" 22° 42' 05.09" 75° 50' 53.02"
2	Niranjanpur to Gurudwara Indore (Kahn)	2.25 ha		24,000	22° 46' 48.25" 75° 53' 08.99" 22° 46' 40.03" 75° 53' 09.55"
3	Laalbhag Magarkuwa Indore (Saraswati)	1.25 ha		17,500	22° 41' 55.24" 75° 50' 52.86" 22° 41' 54.41" 75° 50' 52.47"

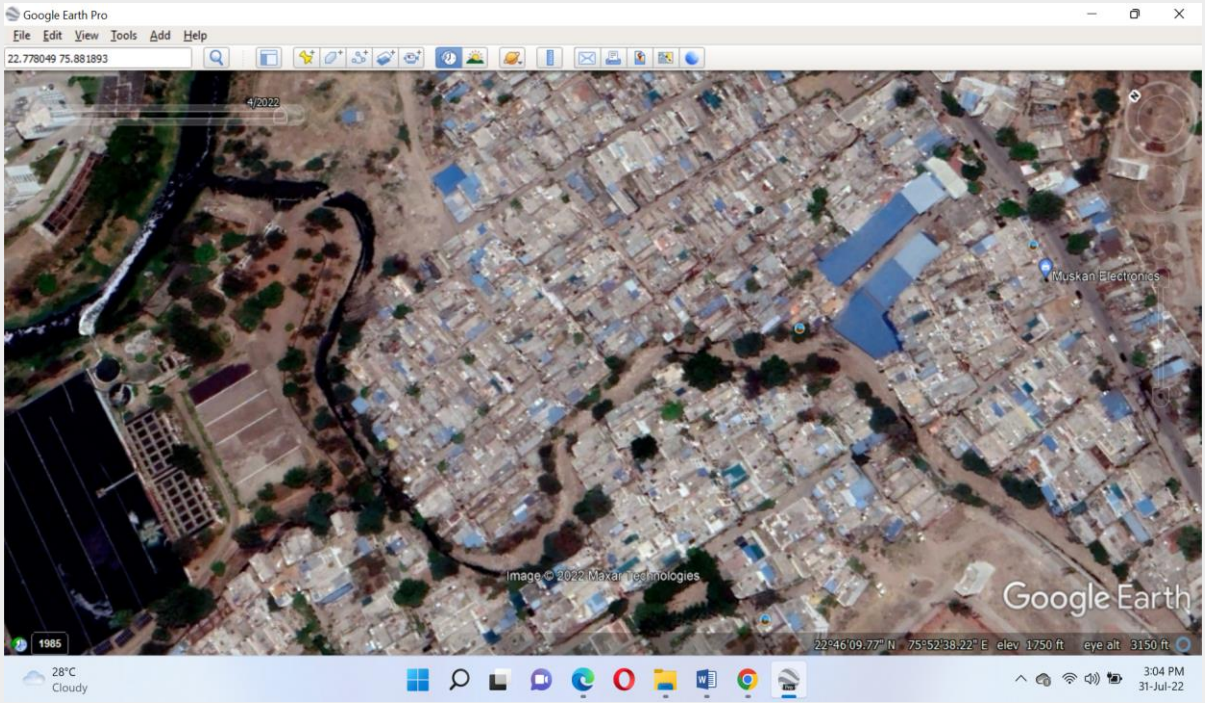
4	Awasa Indore (Saraswati)	1.25 ha	**Distance Not Available**	3,000	22° 40' 15.30" 75º 50' 27.80"
5	Bhagirathipura to Khatipur Indore(Saraswati)	2.25 ha		6,000	22° 44' 30.00" 75º 51' 46.00" 22° 44' 48.00" 75º 51' 55.00"
6	Railway crossing to Bhagirathipur Indore (Kahn)	2.25 ha		6,000	22° 44' 08.00" 75º 51' 51.00" 22° 44' 10.00" 75º 51' 50.00"
7	Hanthipal Indore (Kahn)	1.5 ha		500	22° 42' 48.92" 75° 51' 50.42" 22° 42' 49.17" 75° 51' 50.37" 22° 42' 48.79" 75° 51' 48.49" 22° 42' 48.62" 75° 51' 48.52"
Total				**66,000**	
Indore old Plantation					
1	Kabitkhedi by side of Kahn river	**Area Not Available**	05 km	6,000	Area A 22º 46' 16.09" 75º 52' 04.94" 22º 46' 06.89" 75º 51' 57.32" 22º 46' 15.65" 75º 52' 05.77" 22º 46' 07.24" 75º 51' 56.70" Area B 22º 46' 05.60" 75º 51' 57.49" 22º 46' 05.48" 75º 51' 57.87" 22º 46' 11.38" 75º 52' 02.86" 22º 46' 11.79" 75º 52' 02.34" Area C 22º 46' 04.69" 75º 51' 54.83" 22º 46' 04.28" 75º 51' 53.39" 22º 45' 54.80" 75º 51' 24.34" 22º 45' 54.64" 75º 51' 23.90" Area D 22°46'04.43" 75°51' 57.38" 22º 46' 04.04" 75º 51' 57.37" 22º 45' 58.65" 75º 51' 45.31" 22º 45' 58.46" 75º 51' 44.83"
2	Kahn River Bhangarh Treatment Plant		800 m	2,500	No Co-ordinates provided
3	Bhangarh Shamshan Ghat		01 km	1,000	Area 22° 46' 59.68" 75° 53' 11.15" 22° 46' 59.73" 75° 53' 10.68" 22° 47' 03.12" 75° 53' 11.04" 22° 47' 03.01" 75° 53' 10.21"
4	Bhangarh B		03 km	3,000	Area 22° 46' 31.53" 75° 52' 57.10" 22° 46' 31.52" 75° 52' 58.08" 22° 46' 26.77" 75° 52' 49.59" 22° 46' 25.80" 75° 52' 49.75"
5	Bhangarh C		03 km	3,000	Area 22° 46' 26.76" 75° 52' 49.17" 22° 46' 26.01" 75° 52' 49.29" 22° 46' 14.75" 75° 52' 37.94" 22° 46' 14.85" 75° 52' 37.85"
6	Both sides of Saraswati river	**Area Not Available**	03 km	6,000	Area 22° 41' 25.18" 75° 50' 56.02" 22° 41' 25.32" 75° 50' 55.98" 22° 41' 09.04" 75° 50' 53.00" 22° 41' 08.66" 75° 50' 52.31"
7	Left side of Kahn River from Bhangarh Chauraha downstream		03 Km	6,000	No Co-ordinates provided
Total				**27,500**	

Appendix 4.3

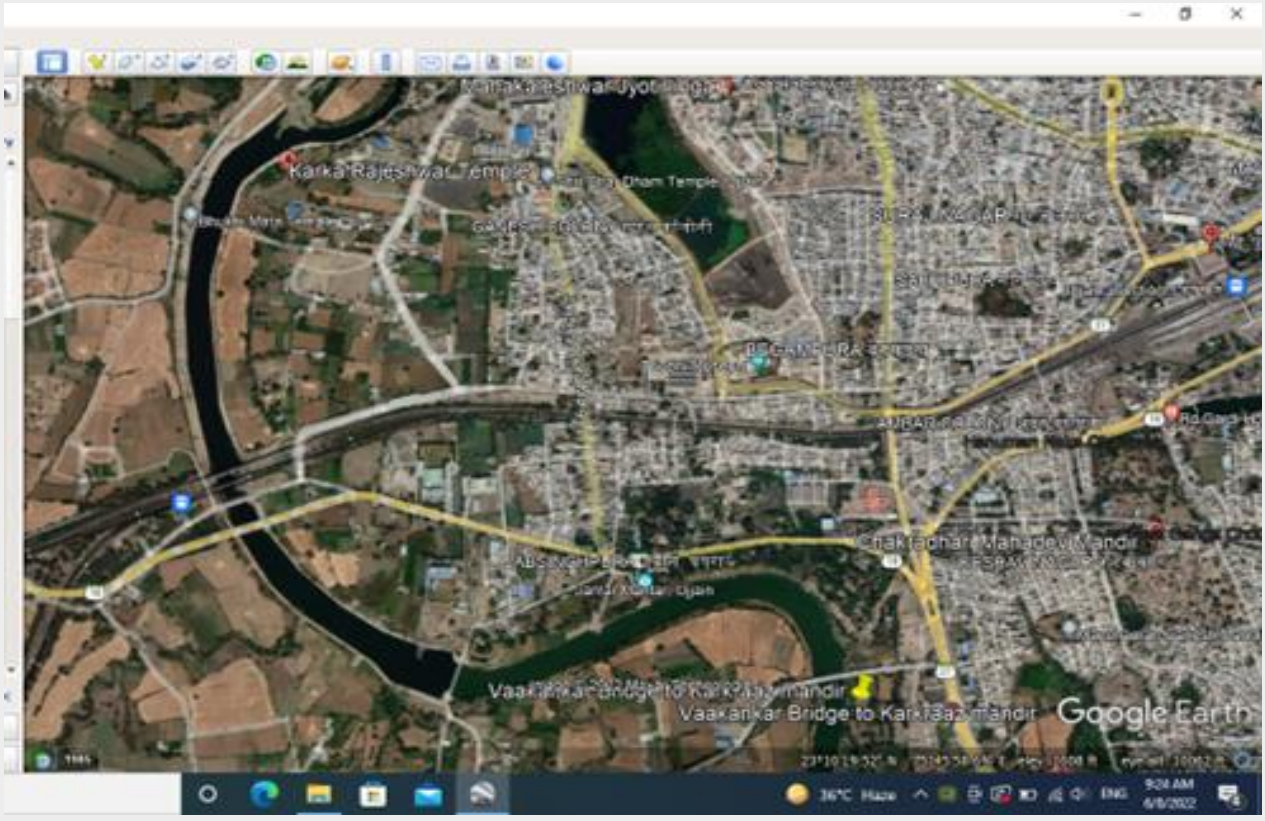
(Reference: Paragraph 4.2.4)

Details of locations where no plantations were found

1) Left side of Kahn River from Bhangarh Chauraha downstream

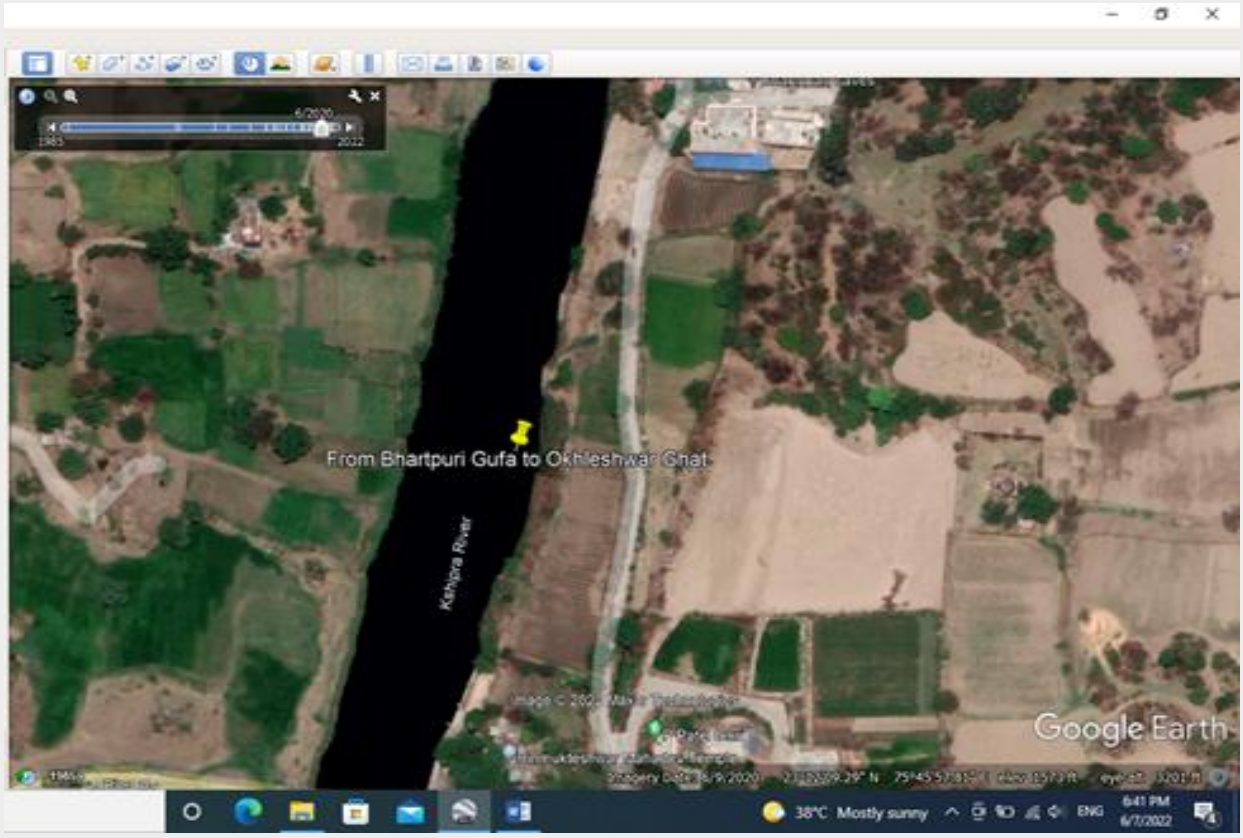


2) South Ujjain i.e., Vakankar Bridge to Karkraj Mandir

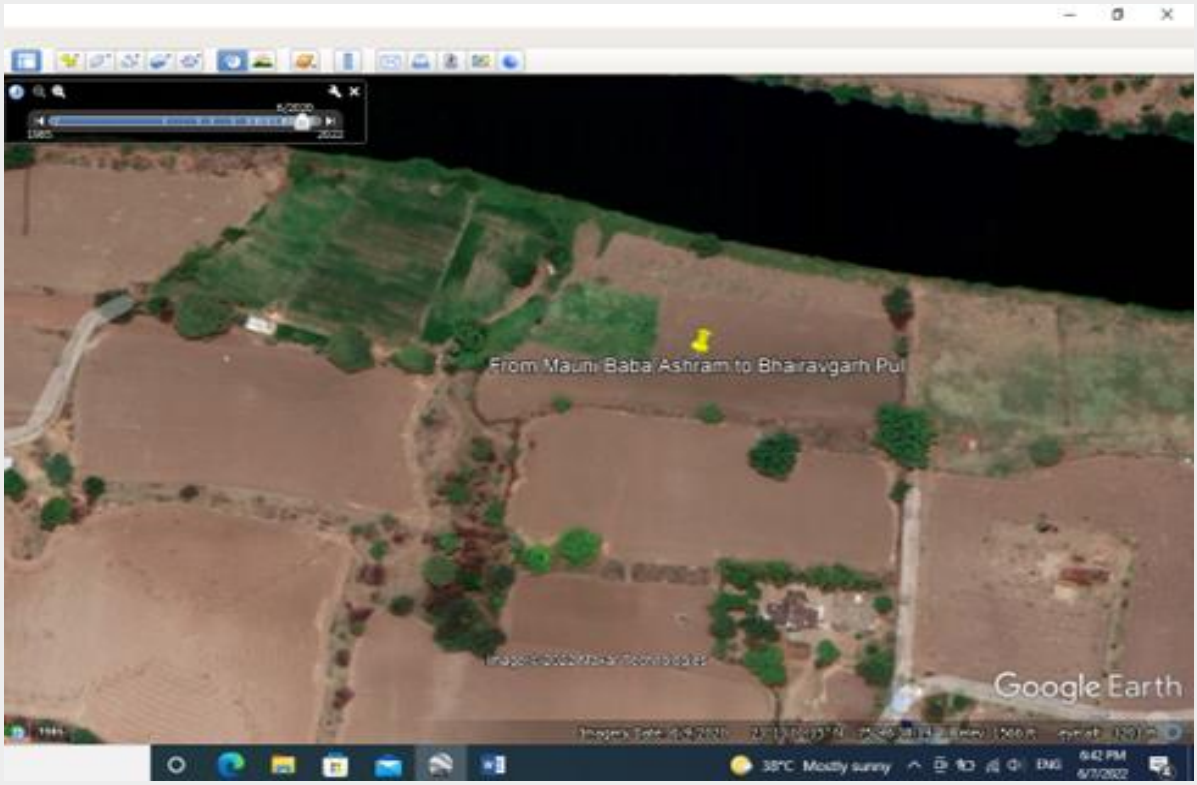


3) North Ujjain i.e., Bhairavgarh bridge to Angeshwar Mahadev

4) North Ujjain i.e., Bharthari Gufa to Okhleshwar Ghat

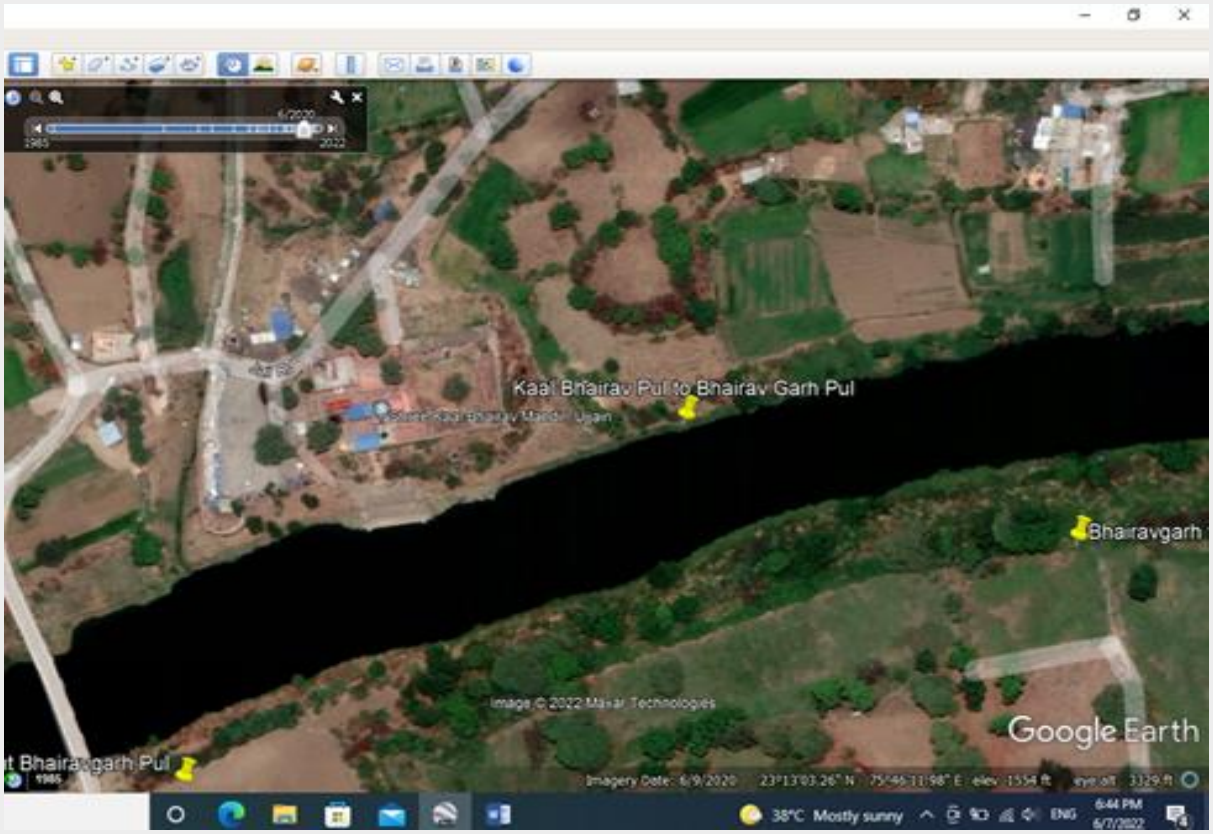


5) North Ujjain i.e., Mauni Baba Ashram to Bhairavgarh Pul

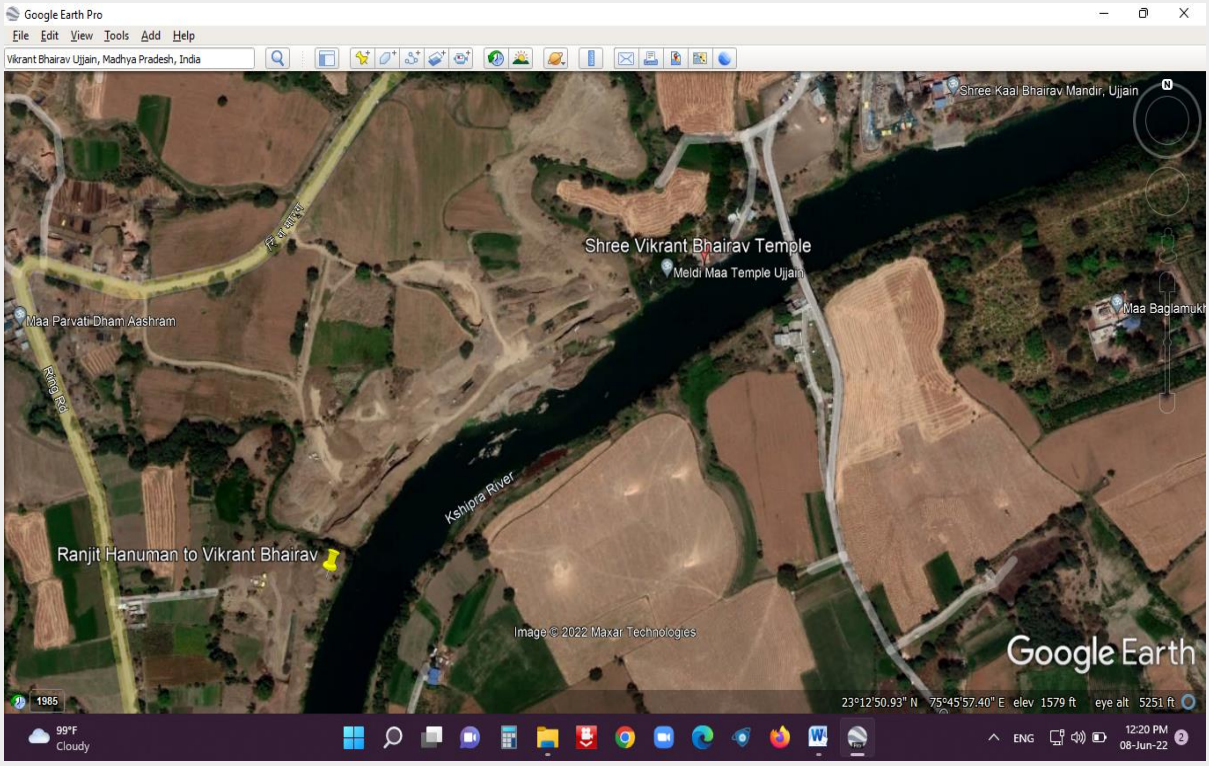


6) North Ujjain i.e., Nallah to Vikrant Bhairav Pul

7) North Ujjain i.e., Kaal Bhairav bridge to Bhairav garh bridge



8) North Ujjain i.e., Ranjit Hanuman to Vikrant Bhairav



9)

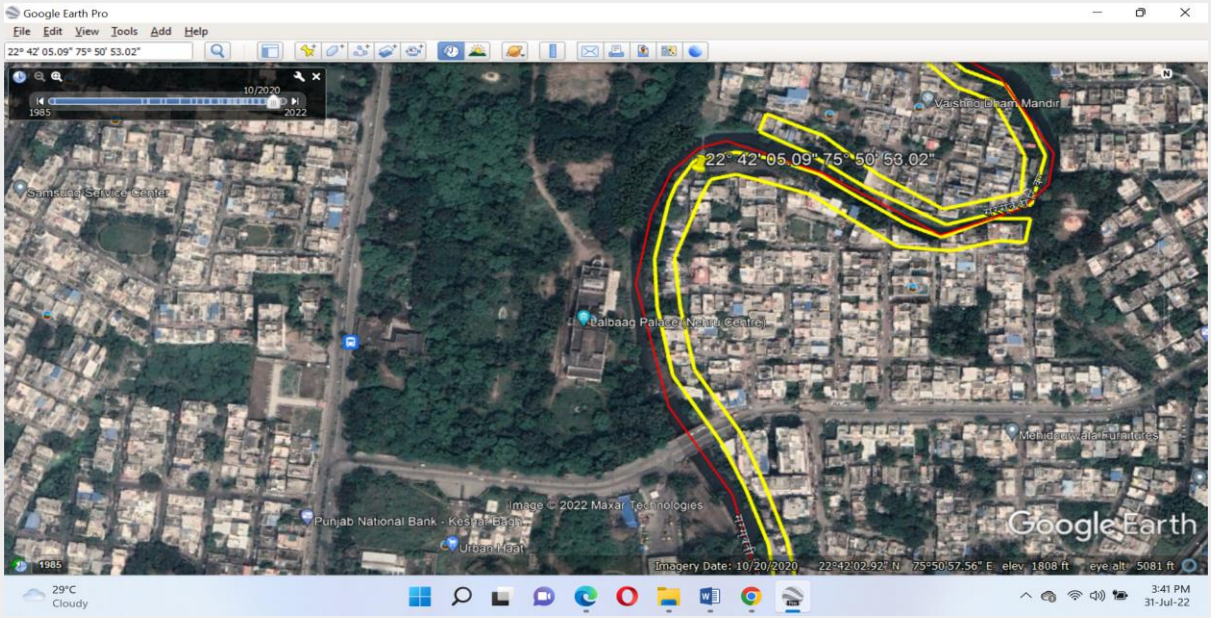
Appendix 4.4

(Reference: Paragraph 4.2.4)

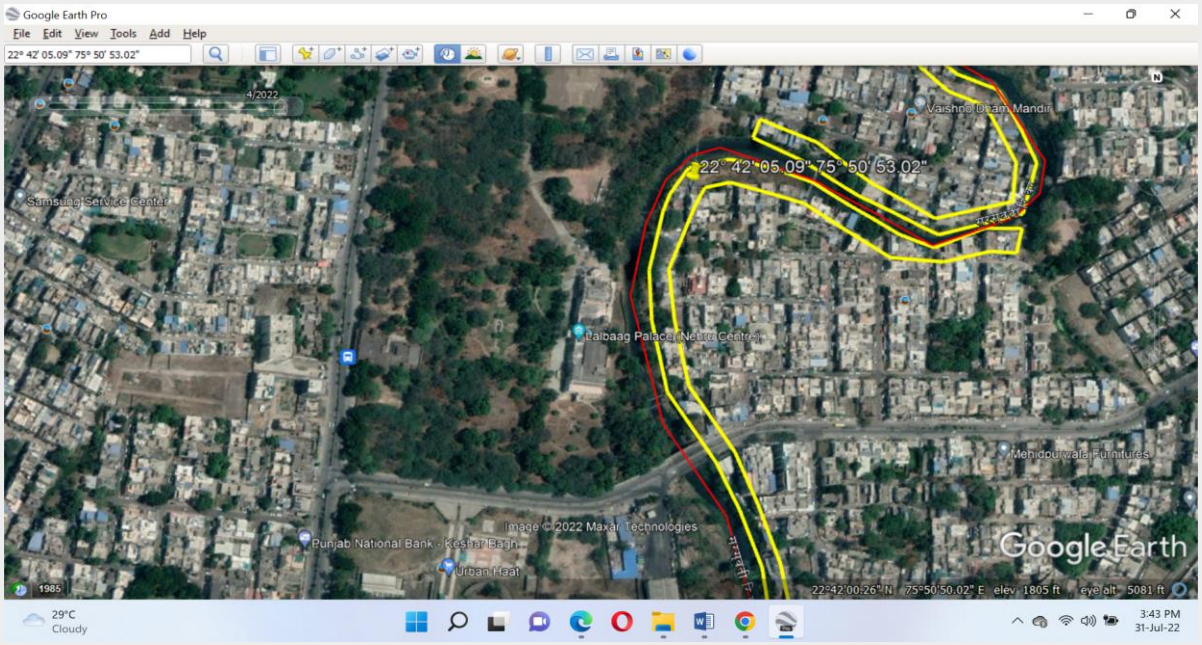
Status of Plantations before planning of Planation and change in status

S.N.	Name of Place	Area (in hectare)	Plantation required	GPS Co-ordinates
1	Laal Bagh, behind Vaishno devi Mandir, Indore (Saraswati)	1.25	9000	22° 42' 05.22" 75° 50' 52.70" 22° 42' 05.09" 75° 50' 53.02"
2	Laal Bagh Magarkuwa Indore (Saraswati)	1.25	17500	22° 41' 55.24" 75° 50' 52.86" 22° 41' 54.41" 75° 50' 52.47"

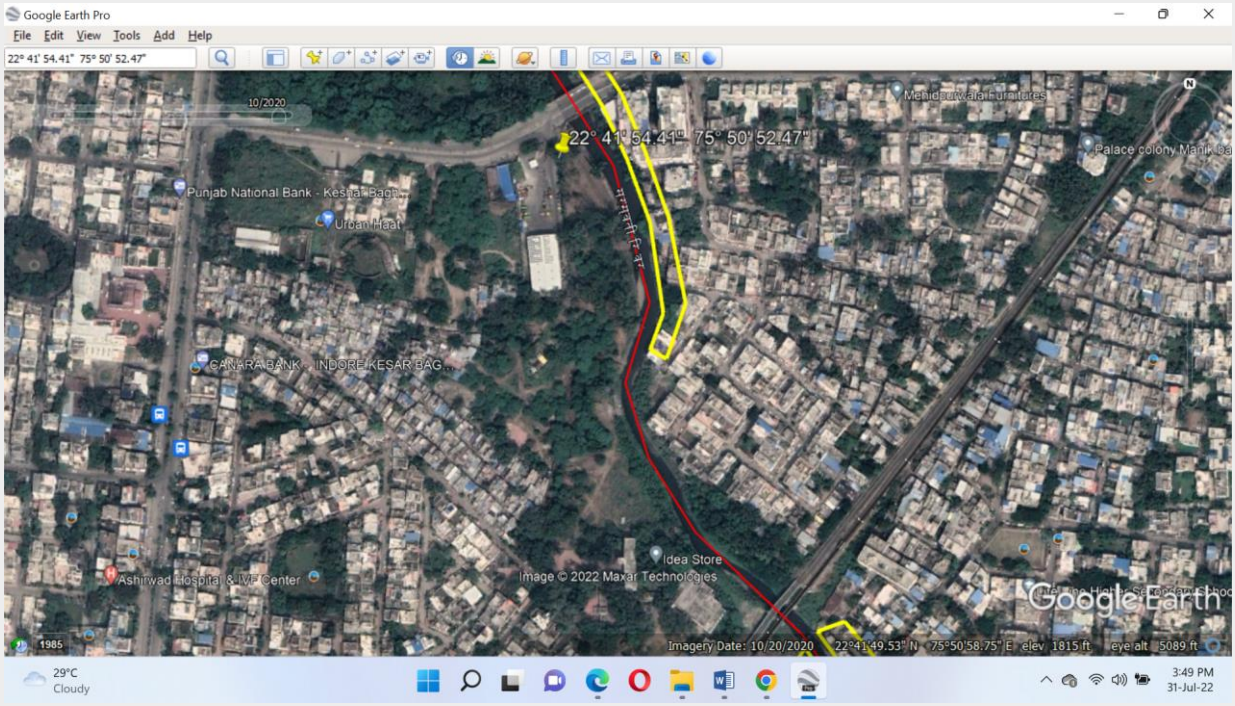
1) Status of Plantations at Laal Bagh behind Vaishno Devi temple, Indore as on October 2020



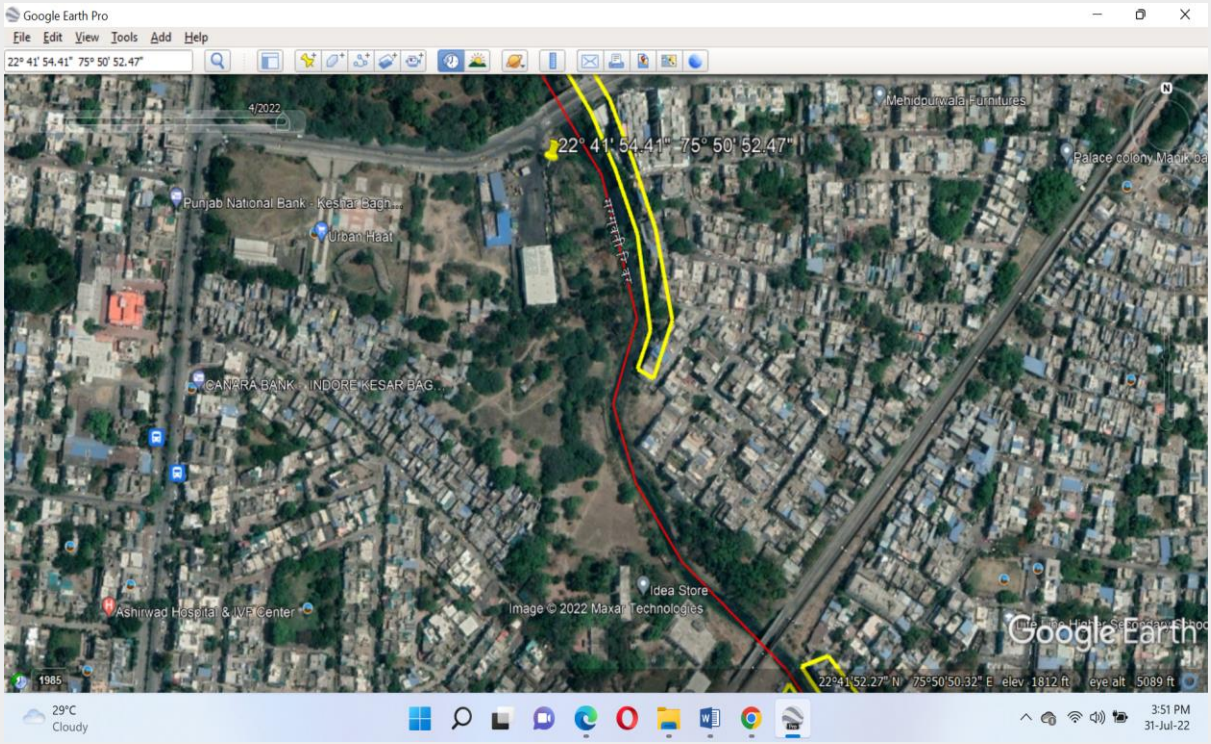
2) Status of Plantations at Laal Bagh behind Vaishno Devi temple, Indore as on April 2022



3) Status of Plantations at Laal Bagh Magarkuwa Indore (Saraswati) as on October 2020



4) Status of Plantations at Laal Bagh Magarkuwa Indore (Saraswati) as on April 2022



GLOSSARY

OF ABBREVIATIONS

Glossary of Abbreviations

S.N.	Abbreviations	Full Form
1	ACR	Annual Confidential Report
2	AE	Assistant Engineer
3	AMRUT	Atal Mission for Rejuvenation and Urban Transformation
4	ASP	Activated Sludge Process
5	BIS	Bureau of Indian Standards
6	BOD	Biochemical Oxygen Demand
7	BoQ	Bill of Quantity
8	CD	Check Dam
9	CETP	Common Effluent Treatment Plant
10	CGWA	Central Ground Water Authority
11	CGWB	Central Ground Water Board
12	CMC	Central Monitoring Committee
13	CMO	Chief Municipal Officer
14	CMP	City Master Plan
15	COD	Chemical Oxygen Demand
16	CP	Cement Plug
17	CPCB	Central Pollution Control Board
18	CPHEEO	Central Public Health and Environmental Engineering Organisation
19	CSP	City Sanitation Plan
20	CSS	Continuous Stream Storages
21	CTO	Consent To Operate
22	CWC	Central Water Commission
23	DFO	Divisional Forest Officer
24	DG	Diesel Generator
25	DLC	Dry Lean Concrete
26	DO	Dissolved Oxygen
27	DPR	Detailed Project Report
28	DWC pipe	Double Wall Corrugated pipe
29	EC	Electronic Conductivity
30	EE	Executive Engineer
31	E-in-C	Engineer-in-Chief
32	EPI	Environmental Pollution Index
33	ETP	Effluent Treatment Plant
34	FAB	Fluidized Aerobic Bioreactor
35	FPZ	Flood Plain Zones
36	FSSM	Faecal Sludge and Septage Management
37	FSTP	Faecal Sludge Treatment Plant

S.N.	Abbreviations	Full Form
38	GoI	Government of India
39	GoMP	Government of Madhya Pradesh
40	GPS	Global Positioning System
41	GSB	Granular Sub-Base
42	GTS	Garbage Transfer Station
43	HDPE	High Density Polyethylene
44	HP	Horse Power
45	IIT	Indian Institute of Technology
46	IRC	Indian Road Congress
47	JJM	Jal Jeevan Mission
48	LD	Liquidation Damage
49	Lpcd	Litres per person (capita) per day
50	MBBR	Moving Bed Bio Reactor
51	MBR	Membrane Bio Reactor
52	MCFT	Million Cubic Feet
53	MCM	Million Cubic Metre
54	MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
55	ML	Million Litre
56	MLD	Million Litre per Day
57	MLSS	Mixed Liquor Suspended Solid
58	MMSKPY	Mukhya Mantri Sthayi Krishi Pump Yojna
59	MORT&H	Ministry of Road Transport and Highways
60	MoUD	Ministry of Urban Development
61	MPN	Most Probable Number
62	MPPCB	Madhya Pradesh Pollution Control Board
63	MPWRD	Madhya Pradesh Water Resources Department
64	NABL	National Accreditation Board for Testing and Calibration Laboratories
65	NB	Nala Bund
66	NGT	National Green Tribunal
67	NITI	National Institution for Transforming India
68	NKSL	Narmada-Kshipra Simhasth Link
69	NMCG	National Mission for Clean Ganga
70	NOC	No Objection Certificate
71	NPS	Non-Point Source
72	NRDWP	National Rural Drinking Water Programme
73	NVDA	Narmada Valley Development Authority
74	O&M	Operation & Maintenance
75	OC	Organic Carbon
76	OCEMS	Online Continuous Emission Monitoring System

S.N.	Abbreviations	Full Form
77	PHED	Public Health Engineering Department
78	PPP	Public Private Partnership
79	PRI	Panchayat Raj Institution
80	PS	Principal Secretary
81	PT	Percolation Tank
82	PVC	Pavement Quality Concrete
83	PWSS	Piped Water Supply Scheme
84	RAB	Running Account Bill
85	RO, PCB	Regional Officer, Pollution Control Board
86	RRC	River Rejuvenation Committee
87	RS	Recharge Shaft
88	SBM	Swachh Bharat Mission
89	SBR	Sequencing Batch Reactor
90	SCADA	Supervisory Control and Data Acquisition
91	SDBC	Semi Dense Bituminous Concrete
92	SDMF	State Disaster Mitigation Fund
93	SDRF	State Disaster Response Fund
94	SE	Superintending Engineer
95	SLB	Service Level Benchmark
96	SLSSC	State Level Scheme Sanctioning Committee
97	SLTC	State Level Technical Committee
98	SOP	Standard Operating Procedure
99	SOR	Schedule of Rates
100	SPCB	State Pollution Control Board
101	sq. km.	Square Kilometre
102	SSI	Small Scale Industries
103	STP	Sewerage Treatment Plant
104	SWM	Solid Waste Management
105	T&CP	Town and Country Planning
106	TKN	Total Kjeldahl Nitrogen
107	TSS	Total Suspended Solids
108	UADD	Urban Administration and Development Directorate
109	UASB	Up flow Anaerobic Sludge Blanket Reactor
110	UDHD	Urban Development and Housing Department
111	ULBs	Urban Local Bodies
112	UT	Union Territory
113	UUPL	Ujjeni to Ujjain Pipeline
114	VUPL	Vikram Udyog Puri Limited
115	VVIP	Very Very Important Person

S.N.	Abbreviations	Full Form
116	WAPCOS	Water and Power Consultancy Services (India)
117	WBM	Water Bound Macadam
118	WQI	Water Quality Index
119	WQMG	Water Quality Monitoring Guidelines
120	XGN	eXtended Green Node (software)
121	ZLD	Zero Liquid Discharge

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